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FOREWORD

The *United States Armed Forces Medical Journal* is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense. The Chairman of the Armed Forces Medical Policy Council and the Surgeons General of the several services invite all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, and officers of the Veterinary Corps of the Armed Forces, and the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this *Journal.*

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Table of Contents

	Page
The Educational System for Regular Army Doctors—*George E. Armstrong*	157
The Physiopathology of Frostbite: A Conjecture on the Development of Dry vs. Wet Gangrene—*Domenic A. Vavala*	163
The Army Medical Service—*Silas B. Hays*	167
A Hospital Tumor Registry—*Bonita Godwin*	175
The Role of Thiamine Hydrochloride in Dentistry: II. Therapeutic Use of Thiamine in Dental Disorders—*James L. E. Bock*	181
Isolated Dislocation and Fracture-Dislocation of the Base of the Fifth Metacarpal Bone—*James P. Abstrom, Jr.*	197
Pathologic Physiology in Epidemic Hemorrhagic Fever—*Giulio J. Barbero, Sidney Katz, and Henry Kraus*	207
Sequelas of Epidemic Hemorrhagic Fever in the Convalescent Patient—*Joseph H. Watson*	211
Patient Triage for Treatment and Evacuation—*James H. Forsee*	217
Anatomic Landmarks in Block Anesthesia of the Inferior Alveolar Nerve—*Stuart Foulke*	223
PULHES: The Physical Profile Serial System—*Eugene C. Jacobs*	235
Articles by Personnel of the Medical Services of the Armed Forces Published in Other Journals	242
Effectiveness of DDT in the Control of Body Lice in Germany—*Ralph W. Bunn*	243
Fatal Anaphylactic Reaction Following Penicillin Injection—*William N. Christenson, Gerald W. Hedrick, and Robert F. Schugmann*	249
Water Chlorination—*Stanley J. Weidenkopf*	253
Heretofore Undescribed Organism Isolated From the Genitourinary System—*Sidney Leopold*	263
Medical Processing of a National Guard Infantry Division—*Anthony Ruppersberg, Jr., and Collins Wight*	267

Page

Plastic Repair of the Eyelid—*Bernard N. Soderberg, William T. Sichi, and Hal B. Jennings, Jr.* 281

Fatal Bacterial Endocarditis Due to Staphylococcus Aureus—*David B. Carmichael, jr.* 287

Immunization Requirements 294

Effects of Cortisone on Acute Rheumatic Carditis—*H. C. Gibson, Dan V. Spivey, Thomas C. Clifford, and David J. Oppenheim* 295

Epidermoid Cyst of the Spleen—*Lawrence L. Bean and LeRoy H. Stablgren* 305

Simultaneous Perforated Appendicitis, Vivax Malaria, and Ascariasis—*William T. Smith and Erik Larsen* 309

BOOKS RECEIVED 162
174, 196, 241

BOOK REVIEWS 205
206, 215, 216, 234, 248, 261, 262, 280, 304

Monthly Message

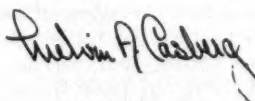
The medical care of Armed Forces dependents has become a hotly debated issue in certain recent discussions of military medical problems. This revival of interest is due in large part to the need for a re-evaluation of medical manpower requirements in light of the necessity for a continuation of the doctor draft law. There are those, and we do not question their sincerity, who are endeavoring to fuse these two problems into one, even to the extent of refusing support to the extension of a draft measure unless certain factors of dependent care are modified. Were it possible to remove entirely the necessity for a draft law by eliminating medical care for dependents, then there might be reason to consider such a stand. It has been demonstrated clearly, however, that this would not result and that the care of dependents represents only a fraction of the projected medical workload during the present period of national emergency.

Whether or not we are faced with the issue of drafting doctors, there still exists a very real problem in dependent care, a separate and distinct matter of extreme importance, the effects of

which on the lives of those in uniform, and hence the national security, run through the very warp and woof of the foundations of our Armed Forces. A matter of such far-reaching significance warrants an exhaustive study by a commission made up of members of the highest national reputation and integrity—civilian and military, doctor and layman. The Armed Forces neither have the inherent right nor the desire to use the question of dependent care as a bargaining commodity in a hasty effort to redeem, as it were, this hostage held as security for the support of another important legislative measure.

We might well pause in serious reflection before encumbering the doctor draft law with prohibitions relative to dependent care, for such limitations might work serious professional, educational, and geographic restrictions on certain categories drafted into the Armed Forces. As a medical reserve officer recently stated, a practice limited primarily to young men would certainly produce a serious degree of professional dissatisfaction.

Never before in our military medical history has there existed such a high level of professional achievement and never before have the bonds of sincere mutual interest and respect between civilian and military professions been so strong. In the interests of the further advancement of our medical status and to further strengthen our national security, there is urgent need for clear unprejudiced thinking on the part of the leaders of American medicine, both in and out of uniform, lest we in hasty action jeopardize our present high level of accomplishment. The doctor draft law must be settled on its own merits and the introduction of dependent care into the debate will serve only to cloud the issue inasmuch as the latter is a distinct and separate matter deserving consideration in its own rights.



Melvin A. Casberg, *M. D., Chairman*
Armed Forces Medical Policy Council
Office of the Secretary of Defense

THE EDUCATIONAL SYSTEM FOR REGULAR ARMY DOCTORS

GEORGE E. ARMSTRONG, *Major General, MC, USA (1)*

THE present postgraduate educational program for medical officers of the Army is in striking contrast to that in effect at the turn of the last century. Prior to that time no planned training programs were conducted for Army medical officers. Armed only with his basic medical education and such professional experience as he might have had in civil life, a physician was commissioned in the Army and given a duty assignment. In some instances this permitted him to work under the guidance of experienced medical officers, but frequently he was thrown entirely on his own resources.

Establishment of the Army Medical School in Washington, D. C., in 1893 by Surgeon General Sternberg was the first step toward the development of formalized postgraduate education. The curriculum of the school placed primary emphasis on professional subjects, including tropical diseases, and devoted some attention to medicomilitary matters. General Sternberg was also responsible for the establishment of organized Army medical research programs conducted by specially selected boards and commissions, the most famous of which was headed by Major Walter Reed. Thus, General Sternberg may be credited not only with recognizing the fact that military medicine presents problems somewhat foreign to those of civilian medicine in the United States, but also with establishing both teaching and research programs stemming from that basic premise.

The next step in the development of formalized teaching took place in 1911 when the precursor of the Medical Field Service School was established as a part of the Fort Leavenworth school system. Based on the medical experience of World War I, the Medical Field Service School was reorganized in its present form in 1921 at the former Carlisle Indian School, Carlisle Barracks, Pa., where it remained until after World War II.

During the interwar period the Army Medical School and the Medical Field Service School supplied most of the medical military training for medical officers of the Army. Soon after being commissioned in the Regular Army, young medical officers

(1) Surgeon General, Department of the Army, Washington, D. C.

were assigned to 9 months of intensive training divided equally between these 2 schools. The Army Medical School concentrated on professional subjects with emphasis on diseases in which the military environment presented special problems. The Medical Field Service School, on the other hand, provided training primarily in administrative and field medical subjects.

In addition to the 9-month basic course, medical officers were required to attend an advanced course at the Medical Field Service School or take a correspondence course as a preliminary to examination for promotion to lieutenant colonel. Subject material in both courses related primarily to command and staff work. Some specialized advanced courses on professional subjects were given at the Army Medical School, but these were attended by relatively few members of the Medical Corps. A small number of officers were also given the opportunity to pursue courses at civilian institutions in public health and kindred subjects. Some medical officers took short courses in professional specialties at their own expense. In general, however, there was no organized program of education, beyond the courses described, to assure continued professional advancement of the Medical Corps.

World War II required drastic modifications of the Army Medical Service educational system. Short, intensive orientation courses were conducted for large numbers of doctors from civil life who had to be placed on duty with the least possible delay. In addition to such basic orientation, many short courses in varied professional and administrative specialties were organized.

At the end of World War II, we faced an entirely new situation. Most of the Reserve officers who had served during the war returned to civil life, and the Regular Corps was thinned by deaths, retirements, and some resignations. Practically all Regular Army physicians had spent the war in command and staff assignments and had been out of close touch with professional work. Thus we had simultaneously to (1) continue to furnish medical service to an Army which, while small in comparison to its size during World War II, was far larger than the prewar Army; (2) provide professional training and refresher courses to members of the Regular Army Medical Corps; and (3) attract highly qualified young doctors to the Army.

We decided that the solution to these problems was an aggressive program of professional education designed to raise the quality of medical service in the Army. Accordingly, an extensive residency training program was established in selected Army hospitals. The Army also sponsored residencies in civilian hospitals. Military and civilian internships were established.

Professional refresher courses in civilian institutions were provided for members of the Medical Corps. Finally, courses in basic sciences were established.

This program was designed not only to provide professional retraining of experienced medical officers, but to qualify larger numbers of our physicians for certification by American Specialty Boards. This was necessary to meet the needs of an Army of the planned peacetime size. Thus, some features of the program were immediate and relatively temporary in nature, while others were long-range. Concurrently with the establishment of a professional educational program, we recognized the necessity for reviewing our training of medical officers in medicomilitary matters, including administration and the military application of clinical subjects.

In the military field a newly commissioned medical officer requires familiarization with the organization and functioning of the Armed Forces and the relationship of the military medical services to other elements of national defense. Professionally he requires additional instruction in preventive medicine, tropical medicine, and such military medical problems as shock, battle wounds, burns, cold injuries, and the care of mass casualties. He also requires orientation in military psychiatry and in chemical, bacteriologic, and radiologic warfare. Such basic training should be given at the outset of a medical officer's career, for unless he has this training his value to the service is greatly reduced.

With these objectives in mind, we developed basic and advanced courses at the Army Medical Service Graduate School in Washington and at the Medical Field Service School, at Fort Sam Houston, Tex. The basic course for young medical officers, the company officers' course, is in 2 phases, each of about 5 months' duration. The first phase, dealing primarily with military and field subjects, is conducted at the Medical Field Service School, and the second phase, concentrating on professional subjects, is given at the Army Medical Service Graduate School. Advanced courses are provided at each school. Although plans for these courses were developed soon after World War II, it was not until the fall of 1951 that enough Medical Corps officers could be spared from strictly professional training and duty assignments to attend the company officers' course. During this time, every effort was made to continue at full capacity the professional educational program.

The outbreak of hostilities in Korea in the summer of 1950 necessitated a temporary contraction of the residency program. Many residents had to be withdrawn from training and assigned to the Far East because of the urgent need to provide an ex-

panded Medical Service. About 1 year later, however, the residency program was again fully staffed.

Whereas in 1946 and 1947 there had been hope that world peace was attainable and that we should have a relatively small military establishment, by 1951 it had become evident that a long period of international unrest and a large Army could be anticipated for many years to come. Continued compulsory service of doctors appeared inevitable. We assumed that for an indefinite period medical service would be supplied to the Army by a relatively small Regular Army Medical Corps and a much larger number of Reserve officers on relatively brief periods of active duty. To deal with this situation, I appointed a board of senior officers in January 1952 to review our educational system.

The problem which the board faced may be stated simply: in view of the continuing necessity for the utmost conservation of medical manpower, what essentials must be taught to the Regular Army medical officer, both in the professional and military areas? The board recognized that maintenance of the highest professional competence is the primary objective of all training for Regular Army medical officers. Proficiency in the military aspects of medicine, including field operations, is also essential.

The following recommendations of the board have been approved and will be put into effect:

1. The military residency program should continue without retrenchment to assure an adequate number of highly qualified specialists.

2. The company officers' course should be reduced to 26 weeks and conducted entirely at the Medical Field Service School. It is now 40 weeks long and split between Fort Sam Houston and Washington. This change will result in a great saving in time, personnel, and money. Shortly after we had decided on this change, the Department of the Army directed that all branch company officers' courses be limited to a maximum of 27 weeks. In other words, the General Staff and my office had independently arrived at the conclusion that company officers' courses should not exceed 6 months.

3. The advanced course should be given at the Medical Field Service School. This course provides advanced branch training in the tactical and administrative duties of field grade officers prior to the twelfth year of their service. It familiarizes them with problems in command and staff they will encounter as senior officers.

4. The basic science course should be recast to train carefully selected physicians in scientific research instead of serving as an intensive preparation for Regular Army medical officers seeking certification by American Specialty Boards. Education in the basic sciences continues to be an essential part of residency training, but the board proposed that residents get this as a part of the regular residency training, rather than in a single concentrated course. As presently envisaged, officers selected for the course will be given an opportunity to develop in the fields of research and highly specialized clinical work.

5. A short course for hospital commanders should be developed. In the event of full mobilization members of the Regular Corps should be able to open new hospitals and administer them, leaving most of the purely professional jobs to physicians from civil life with little knowledge of Army management methods.

6. A preventive medicine course of about 9 months should be developed by the Army Medical Service Graduate School and the Preventive Medicine Division of my office. This instruction would be the equivalent of a public health course in a civilian medical school. We hope to begin the first such course in September 1953.

7. A short refresher course in professional subjects should be organized for senior medical officers and given at the Army Medical Service Graduate School. This course would probably be only a few weeks long and would be held once or twice a year. Most students would be senior officers whose normal duties are outside the strictly professional field, although physicians in such highly specialized fields as ophthalmology might also attend. Officers would attend this course on temporary duty status and would repeat it every 3 to 5 years.

As a result of my study of the board's recommendations, I have appointed another committee to give detailed consideration to the curriculums of the various courses in our 2 principal schools. Before reaching a final decision on the board's recommendations, I called a meeting of our Advisory Board of Civilian Consultants, together with other prominent civilians in the field of medical education. This group expressed unqualified concurrence in the proposed educational program. I believe the recent study of the Army educational system for doctors has been worth while and will enable us better to fulfill the mission of the Army Medical Service.

BOOKS RECEIVED

Oestrogens and Neoplasia, by *Harold Burrows* and *Eric S. Horning*. With contributions by *W. C. J. Ross* and *C. W. Shoppee*. 189 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $6.75.

Dermatology, Essentials of Diagnosis and Treatment, by *Marion B. Sulzberger*, M. D., Professor and Chairman, Department of Dermatology and Syphilology, New York University Post-Graduate Medical School; Director of Dermatology and Syphilology, Skin and Cancer Unit and University Hospital, New York University-Bellevue Medical Center; Captain, MC, U. S. N. R., and Consultant Dermatologist to the Bureau of Medicine and Surgery, United States Navy, and *Jack Wolf*, M. D., Associate Professor of Clinical Dermatology and Syphilology, New York University Post-Graduate Medical School; Attending Dermatologist and Syphilologist, Skin and Cancer Unit and University Hospital, New York University-Bellevue Medical Center. 592 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1952. Price $10.

The Physiologic Effects of Wounds, by *the Board for the Study of the Severely Wounded, North African-Mediterranean Theater of Operations*. Medical Department, United States Army, Surgery in World War II. 376 pages; illustrated. Office of the Surgeon General, Department of the Army, Washington, D. C., 1952.

Practical Blood Grouping Methods, A Manual of Immunohematology, by *Robert L. Wall*, M. D., Department of Research Medicine, The Ohio State University Hospital, Columbus, Ohio; Formerly, Blood Research Section, Department of Biologic Products, Army Medical Department Research and Graduate School, Washington, D. C. Publication Number 122, American Lecture Series. A Monograph in The Bannerstone Division of American Lectures in Hematology. Edited by *Russell L. Haden*, M. D., Formerly, Chief of the Medical Division, Cleveland Clinic, Cleveland, Ohio. 175 pages. Charles C Thomas, Publisher, Springfield, Ill. 1952.

The 1952 Year Book of Pediatrics (June 1951-May 1952), edited by *Sydney S. Gellis*, M. D., Assistant Professor of Pediatrics, Harvard Medical School; Senior Physician, Children's Medical Center, Boston; Pediatrician-in-Chief, Beth Israel Hospital, Boston. *Isaac A. Abt*, M. D., Editor Emeritus. 423 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1952. Price $5.50.

Congenital Anomalies of the Heart and Great Vessels, by *Maurice A. Schnitker*, B. S., M. D., F. A. C. P., Lt. Col., AUS, Medical Consultant, Pacific Theater, World War II; Director of Medicine, St. Vincent's Hospital; Senior Active Staff, Toledo Hospital and Maumee Valley Hospital; Consulting Staff, St. Luke's Hospital and Toledo State Hospital. 306 pages; illustrated. Oxford University Press, New York, N. Y., publishers, 1952. Price $8.

Ophthalmic Pathology, An Atlas and Textbook, by *Jonas S. Friedenwald, Helenor Campbell Wilder, A. Edward Maumenee, T. E. Sanders, John E. L. Keyes, Michael J. Hogan, W. C. Owens*, and *Ella U. Owens*. With the editorial assistance of *Helen Knight Steward*. Published under the joint sponsorship of the *American Academy of Ophthalmology* and *Otolaryngology* and the *Armed Forces Institute of Pathology*. 489 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1952.

THE PHYSIOPATHOLOGY OF FROSTBITE

A Conjecture on the Development of Dry vs. Wet Gangrene

DOMENIC A. VAVALA, *Second Lieutenant, USAF (MSC)* (1)

VASOCONSTRICTION is a protective mechanism for maintaining a constant body temperature. Shumacker (2) stated that the degree of vasoconstriction varies according to the susceptibility of a person's vasomotor responses, the amount of body surface exposed, and the intensity of the cold. According to Lewis (3), the mechanisms involved are: (1) a local vasoconstriction which is the direct effect of the cold on the blood vessels, (2) a local reflex vasoconstriction mediated via the sympathetic nerves, and (3) a generalized vasoconstriction resulting from the action of the chilled blood on the vasomotor center. Thus, the cold stimulus acts not only locally and directly, but also centrally and reflexly. The second reaction can be demonstrated if a limb is cooled while its circulation is cut off. The result is an immediate and transient general vasoconstriction in the limb (4). The third reaction is observed when the circulation to the cooled limb is restored, producing a generalized and persistent vasoconstriction (4).

On exposure to cold there is an immediate peripheral vasoconstrictor response (2, 3, 5, 6). This observation was again confirmed in patients with frostbite by the Cold Injury Research Team of the Army Medical Research Laboratory, Fort Knox, Ky., in the Osaka Army Hospital, Osaka, Japan, during the winter of 1951-1952. Patients were allowed to become adjusted to a room temperature of 72° F. for 1 hour and then were moved into a

(1) U. S. Air Force School of Aviation Medicine, Randolph Air Force Base, Tex. Former physiologist, Army Medical Research Laboratory, Fort Knox Cold Injury Research Team, Osaka Army Hospital, Osaka, Japan.

(2) Shumacker, H. B., Jr.: Injuries due to cold, with particular reference to frostbite and trench foot. Wisconsin M. J. 46: 317-324, Mar. 1947.

(3) Lewis, T.: Observations on some normal and injurious effects of cold upon skin and underlying tissues; reactions to cold, and injury of normal skin (Holme Lecture). Brit. M. J. 2: 795-797, Dec. 6, 1941.

(4) Pickering, G. W.: Vasomotor regulation of heat loss from human skin in relation to external temperature. Heart 16: 115-135, July 1932.

(5) Davis, L.; Scarff, J. E.; Rogers, N.; and Dickinson, M.: High altitude frostbite; preliminary report. Surg., Gynec. & Obst. 77: 561-575, Dec. 1943.

(6) Friedman, N. B., and Kritzler, R. A.: Pathology of high-altitude frostbite. Am. J. Path. 23: 173-187, Mar. 1947.

walk-in refrigerator in which the temperature was thermostatically maintained at 50° F. Skin temperature readings of the patients taken at room temperature and immediately on entry into the refrigerator demonstrated an immediate response to cold by an abrupt fall in skin temperature. The fall in skin temperature reflected the vasoconstrictor response.

The acute stage of frostbite is manifested by pallor resulting from the vasoconstriction, which may persist for 24 hours or longer. Davis et al. *(5)* reported that direct microscopic examination of the terminal capillary beds in human finger tips soon after exposure to intense cold showed the peripheral ends of the arterioles to be well filled with blood and the terminal capillary loops to be empty. Thus, if the capillary beds have been deprived of their blood supply by the spasm of the terminal arterioles, the pallor observed in the acute stage is understandable. The degree and duration of the vasospasm determines the amount of damage inflicted on the involved tissues. Severe damage to the endothelium of the terminal capillaries may result in pathologic permeability of the capillary walls, as evidenced by the presence of edema. This was a frequent finding in patients with fourth-degree frostbite incurred in Korea during the winter of 1950-1951. The vasoconstriction resulting from exposure to extremely low ambient temperatures or prolonged exposure to cold may be severe enough to cause tissue death from ischemia. Siegmund *(7)* named 5 investigators who observed the development of frostbite in infantrymen and flying personnel of the German Army and Air Force soon after exposure to cold, and all agreed that the tissue changes were caused by anemia due to arterial and capillary constriction. Friedman and Kritzler *(6)* attributed the pathologic changes occurring in lesions of high-altitude frostbite to ischemia rather than to direct freezing of the tissues.

One of our patients was admitted with a diagnosis of fourth-degree frostbite of the right foot. As a result of shell fragments in the left thigh with injury of the left peroneal nerve, the patient was completely immobilized on the ground for 30 minutes at an ambient temperature of from -4° to +2° F. Apparently, the nerve injury of his left leg prevented a vasoconstriction of the same magnitude as was present in his right foot. Thus, his injured leg received adequate circulation and sufficient heat to ward off frostbite.

Hyperemia, which follows the vasoconstrictor or prehyperemic stage, occurs during the thawing period and is followed by extravasation of blood and plasma through the damaged capillary walls. This results in blisters and in extensive edema of the

(7) Siegmund, J.: Pathology of general and local frostbite. Jahresk. f. arztl. Fortbild. 34: 9-19, Jan. 1943 (Translation).

affected tissues. This stage of reactive hyperemia is thought to be partially due to the local liberation of histamine or a histamine-like substance (2).

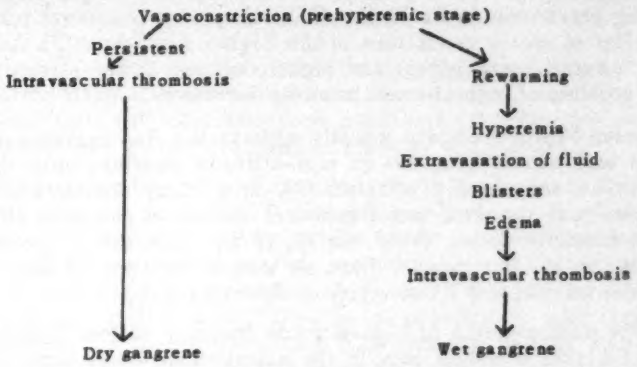


Figure 1. Schema of suggested course of events in the development of dry or wet gangrene in frostbite.

It has been reported that pathologic specimens of gangrenous tissue removed weeks or months after exposure showed thrombi in all vessels (8). Fourth-degree frostbite is always accompanied by the development of gangrene, either wet or dry. It would seem that if thrombosis of the vessels occurred after rewarming, the subsequent ischemic tissues would develop a wet gangrene. This type of tissue necrosis would be based on the extravasation of fluid, edema, and blistering which would occur following rewarming but prior to vascular obliteration by thrombosis. On the other hand, if intravascular thrombi had been firmly established at the arteriolar-capillary junctions before release of a persistent vasospasm, it would seem that the stage of reactive hyperemia, followed by extravasation of fluid and blistering, would not occur. This sequence of events would seem to favor the production of a dry gangrene. These speculations seem to be corroborated by Davis et al. (5).

Thrombotic obliteration of the superficial cutaneous vessels with concomitant patency of the deep vessels would probably result in the development of a superficial gangrene. Whether this gangrene would be wet or dry would probably depend on the amount of pathologic capillary permeability of the deep vessels. Thrombosis of both the superficial and deep tissue vessels would result in both superficial and deep gangrene. The occurrence of thrombosis either following the initial persistent vasospasm or

(8) Orr, K. D., and Fainer, D. C.: Cold injuries in Korea during winter of 1950-51. Medicine 31: 177-220, May 1952.

following the period of rewarming seems to determine the type of gangrene that ensues (fig. 1).

High-altitude frostbite has been and is still of major concern to flying personnel. In World War II it occupied a prominent place on the list of battle casualties in the Eighth Air Force *(9)*. As military aircraft reach higher and higher ceilings in the stratosphere, the problem of high-altitude frostbite increases.

Ground-level frostbite usually affects the flat surfaces of the face and extremities, but in high-altitude frostbite only the extremities are usually affected *(5)*. In a study conducted on 20 airmen (tail gunners, turret gunners, and waist gunners) afflicted with frostbite during World War II, 15 had frostbite of the fingers alone; in 19, the cheeks, face, or toes in addition to the fingers were involved, and 1 had injury to the buttock *(5)*.

The pathogenesis of high-altitude frostbite differs from that of ground-level frostbite only in the extremes of temperature experienced and the duration of exposure. Extremely low temperatures (-40 to -52° C.) are encountered by patients who suffer high-altitude frostbite. Exposure to such low temperature causes an extreme degree of vasospasm, both direct and reflex, producing marked ischemia which results in severe anoxemia and tissue damage. Under standard operating conditions, pressurized cabins and oxygen equipment maintain normal oxygen tensions. At high altitudes, the breathing of atmospheric air with a reduced oxygen tension due to poor oxygen discipline, faulty oxygen equipment, or accident at altitude will further enhance anoxemia. The combination of extreme cold at high altitudes and anoxemia may cause severe tissue damage in 1 or 2 minutes, whereas in ground-level frostbite a much longer period of exposure is necessary before severe damage results.

CONCLUSION

It is suggested that ground-level frostbite and high-altitude frostbite not be considered as separate entities. The two terms should only be used to designate the level at which the injury is incurred. The pathogenesis of ground-level and high-altitude frostbite appears to be the same. The only differences between the two is the ambient temperature at which each occurs and the duration of exposure necessary for severe tissue damage.

(9) Trench foot. Special article prepared in the Office of the Surgeon General. Bull. U. S. Army M. Dept. 74: 46-48, Mar. 1944.

THE ARMY MEDICAL SERVICE[1]

SILAS B. HAYS, *Major General, MC, USA* [2]

IN executing its mission of "conserving fighting strength," the Army Medical Service works in three general areas: (1) the selection and elimination of personnel, (2) the prevention of disease, and (3) the treatment of the sick and injured.

Before proceeding to a discussion of these, I should like to mention some of the principal internal problems now confronting the Medical Service. Most important is our continuing shortage of trained professional personnel, including physicians, dentists, nurses, and certain categories of specialists. As you know, the threat of Public Law 779—the doctor-dentist draft law—has enabled us to meet minimum requirements for the Medical and Dental Corps since shortly after the outbreak of hostilities in Korea. If Congress should fail to renew this law beyond its 30 June 1953 expiration date, our shortage of physicians and dentists would become acute overnight.

Another of our more persistent headaches concerns training—both military and professional for our officer and enlisted personnel. Despite the dislocations caused by the Korean conflict, we are continuing our military residency program and seeking to assure medical officers progressive professional development in the service. This is by no means easy.

A third major area of concern for the Medical Service is the creation of an adequate mobilization reserve of materiel. After World War II we were obliged to liquidate enormous stocks of medical supplies and equipment, and only last year were we again authorized to begin building a balanced stockpile for use in full-scale war. We are slowly accumulating this reserve, but the situation could hardly inspire complacency.

Medical research and development is our fourth main problem. Our present program is about 1,000 times as large as that for 1938. This tremendous effort demands careful planning and coordination with other agencies. We must constantly review our whole program to see that money is not being wasted.

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(1) Condensation of paper presented at the Army War College, Carlisle Barracks, Pa., on 15 December 1952.

(2) Deputy Surgeon General, U. S. Army.

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These are our principal problems. I should like now to return to the 3 main areas of responsibility which make up the mission of the Army Medical Service.

In the *first* area—the selection and elimination of personnel—our job has been to help maintain armed forces of 3,600,000 men without lowering physical or mental health standards for enlistment or induction. Even now we are barely able to maintain our authorized strength with the help of regular monthly levies on Selective Service. If Congress should determine that this country needs a larger military establishment, we should have to begin drafting veterans or lower our physical standards, or both.

Classification and assignment, although ultimately Adjutant General and command functions, are becoming of increasing concern to the Medical Service. We are being called on to formulate practical physical profiles to fit the myriad jobs in today's Army of specialists. We have only begun this work, but the need is urgent for objectively determined physical standards by which we can select the combat infantryman, the cook, the truck driver, and the typist. This relatively new role of advising and assisting in the classification and assignment of personnel is occupying our attention from Department of the Army level on down to platoon level. In the Surgeon General's office we are actively engaged in formulating a set of standards for optimum assignment of all personnel. We hope that these criteria, refined by experience, may some day become a recognized part of Army doctrine. We realize, however, that this program is long range in nature and involves the continuing education of both line and medical officers.

Our *second* main field of activity is preventive medicine and, more recently, preventive psychiatry. Despite the successful conquest of many communicable diseases, many problems remain. Hepatitis, which caused us to lose 10 million man-days between 1941 and 1945, is still exacting a heavy toll in both the Far East and Europe. Research was hampered by the lack of a laboratory animal to which the disease could be transmitted, but recent reports indicate that mice inoculated with materials from a fatal human case have developed a transmissible form of hepatitis.

Like so many other aspects of our preventive medicine program, the excellent record on diarrhea and the dysenteries in Korea is as much a tribute to line commanders and their troops as it is a testimonial to the Medical Service. With almost universal water pollution, conditions in Korea are ideal for the propagation of these ailments. Yet even in the chaotic first year of fighting, the incidence of diarrhea and dysentery in Korea was less than half that for World War II in Italy or the Philippines

and less than one-fourth that in the China-Burma-India Theater. Our experience in treating these conditions with streptomycin, chloramphenicol, and terramycin is similarly encouraging.

Preventive psychiatry is a relatively unexplored field. It offers a fascinating challenge to line and medical officers alike. We are now operating mental hygiene consultation services in 16 troop-training divisions in the United States, including all basic-training centers and 2 replacement training centers. Mental hygiene staffs are now an organic part of the division's medical section. They consist of a team of psychiatrists, clinical psychologists, psychiatric social workers (commissioned and enlisted), and clinical psychology technicians. Begun in 1948, this program is being broadened to include all training centers in the States.

Despite the lowering of mental health standards for induction or enlistment in 1948, separations for psychiatric causes have been low. Men are now being separated for these conditions at a rate which is less than half of the corresponding rate for World War II. Much of the credit for this achievement must go to the combat psychiatry teams now attached to division clearing stations in Korea. These units practice both preventive and curative psychiatry and have been able to return up to 70 percent of all patients with combat exhaustion to duty within the division area since the beginning of the Korean conflict.

The fatality rate among wounded reaching medical care has been reduced to the all-time low of 2.4 percent. The proportion of men killed in action among all those hit in Korea has been about the same as in World War II. These facts led the military services to consider the adoption of a form of body armor. A special test team reported this fall that more than two-thirds of all missiles striking vests used experimentally in Korea were stopped, resulting in up to a 70-percent reduction in serious chest and abdominal wounds. In addition, from 25 to 35 percent of chest and abdominal wounds sustained by soldiers wearing the armor during the test period were reduced in severity.

Another phase of our preventive medicine program is the veterinary food inspection service. Veterinary inspection detachments examined over 4 billion pounds of meat and other food of animal origin during the last fiscal year. Of this total, more than 127 million pounds were rejected for failing to meet health standards set for issue and consumption. Besides the contribution of this work to safeguarding the health of military personnel, it also saved the Government in the last fiscal year over 13 million dollars, which would otherwise have been spent on food products unfit for troop consumption.

Our *third* major field of responsibility is the treatment of the wounded and the diseased. In military medicine, treatment means evacuation, hospitalization, and rehabilitation. Perhaps the most important difference between military and civilian medicine is the mass evacuation of casualties. The Surgeon General suggested in his talk here last year that we might amend the traditional Medical Field Service School motto to read "To conserve fighting strength *where it is needed.*" This epitomizes our conviction that treatment should be conducted as far forward as possible to minimize the ebbing away of troop strength through medical channels. This emphasis on the earliest possible treatment with the least possible evacuation rearward dominates our thinking on every problem of battlefield medicine, including combat exhaustion, dental care, battle wounds, and optical repair and maintenance.

To augment close-in medical support for combat troops, we have substituted the regimental medical company for the old regimental medical detachment of World War II. This change almost triples the organic medical support available to a regiment in combat and has meant the assignment of one medical aidman to every rifle platoon. Division medical service has been similarly bolstered by the addition of (1) 18 dentists, capable of handling 95 percent of the division dental workload, and (2) a neuropsychiatric team in the clearing station complement. Creation of the 60-bed mobile army surgical hospital (MASH), which can be readily augmented in case of need, has brought definitive surgery to the division area. Skilled neurosurgeons, anesthetists, and nurses now serve in these units within sound of artillery fire.

Augmented forward-area medical service has enabled us to return from 35 to 40 percent of all battle casualties to duty with their units without evacuating them beyond the division clearing station. The MASH has helped reduce the death rate, cut disability, and shortened subsequent hospitalization for severely injured patients who require definitive surgery before further evacuation.

It is important that it be decided early which patients should be evacuated to the zone of the interior and which should be retained in the theater. Any decision of this sort must be based on the theater's evacuation policy. An evacuation policy is simply the maximum number of days a casualty may be retained at any echelon (battalion aid station, MASH, or communications zone general hospital). It is essential that patients who will be hospitalized for a greater number of days be evacuated promptly. This decision must be based on sound medical judgment. For example, assume an evacuation policy of 30 days for a hospital in Taegu, Korea. A patient arrives at the hospital with a gunshot

wound of the arm. He is immediately evaluated and if it is determined that 45 days will be required before he will be ready for duty, he is transferred to the rear promptly; not after he has spent 30 days in the Taegu hospital. If, on the other hand, it is determined on arrival that he will be ready for duty in less than 30 days, he is retained at Taegu for complete treatment.

Considerations of logistics, the type of operations being conducted, intensity of combat, and the adequacy of medical facilities enter into the determination of an evacuation policy. Different echelons in an overseas theater have different evacuation policies. Patients may be retained in the division area only a few days. They are frequently held as long as 30 days in rear-area evacuation hospitals. If they require longer hospitalization, they are usually removed to fixed-bed station and general hospitals in the communications zone. During the present hostilities we have adopted a 120-day evacuation policy for the Far East Command as a whole. Most patients whose prognosis indicates longer hospitalization are transferred by airlift to the States.

In any event, the evacuation policy must be flexible at every level. A heavy influx of casualties, interruption of the arrival of replacements, supply stoppages, and many other variables may force the theater commander and his surgeon to revise their evacuation policies upward or downward.

An evacuation policy is only as effective as the medical units which put it into effect. They include the battalion aid station, forwardmost unit of the regimental medical service, where all patients requiring anything more than the services of an aidman are treated. From the aid station, casualties may be returned to duty or sent on back to the regimental collecting station. Critically wounded men may be flown by helicopter directly to a MASH. In the division clearing station it is decided whether to send a casualty beyond the division area or to retain him in the combat zone.

For those men who do need further hospitalization, the next step is a 400-bed semimobile evacuation hospital. We call these units semimobile because they can move their equipment and tentage by shuttle, but require the assistance of a truck company if the entire hospital pulls up stakes at one time. Supplementing these units are the more fixed 750-bed evacuation hospitals, usually allocated on the basis of 3 to a typical field army. Both kinds of evacuation hospital provide definitive surgical and professional nursing care.

An important adjunct to the evacuation hospital is the convalescent center. Since World War II, we have reorganized this unit and 3 such centers, each with a 1,500-patient capacity, will

operate behind a typical field army. Each convalescent center includes a 300-bed hospital and facilities for the rehabilitation of soldiers prior to their return to full duty.

Station and general hospitals provide the most definitive medical care available in a theater of operations. They are also the last port of call for patients who are to be evacuated to the zone of the interior. The location of these facilities is usually dictated more by logistic necessity than by Medical Service doctrine.

The terminal point in the chain of evacuation is the large, named Army hospital in this country, providing definitive care for all types of patients. In addition, we have established 15 specialized-treatment centers by augmenting the medical staffs of selected station hospitals throughout the country with skilled surgical and other specialist personnel.

Evacuation implies transportation. Providing a flexible means of transporting casualties under the most adverse weather and terrain conditions in a combat zone is necessary if patients are to be properly treated. All means of evacuation are being used in Korea. They include simple "man-carry," litters, jeep ambulances, regular ¾-ton ambulances, helicopters, hospital trains, road-rail ambulances, hospital ships, and transport planes of many sizes and ranges.

Each of these means of evacuation has its place in medical service operations. Each is indispensable in one or more situations, and each must be provided in any realistic, flexible plan for enabling casualties to reach a treatment facility. No one means of evacuation can wholly supplant another. They supplement one another and dovetail into a coherent scheme of evacuation. Ideally, each conveyance should be exclusively for medical use. Practically, logistic economy requires us to share cargo space in planes with the supply services. The classic pattern is to return patients in aircraft which have brought needed personnel and supplies forward.

The Medical Service has recently received approval on the Table of Organization and Equipment for a helicopter ambulance unit to function as an integral part of our field organization in a theater of operations. These units will include five 2-rotor utility helicopters capable of carrying 3 litter patients or 4 ambulatory patients, a medical attendant, and a pilot. They will be flown by Medical Service Corps lieutenants. In their enthusiasm for helicopters and light aircraft, I fear that some of their proponents tend to forget their limitations. Besides carrying a small pay load, helicopters require extensive maintenance, a suitable landing place, and good flying weather. Their use might have to be drastically restricted against an enemy with much

tactical airpower. In such a situation, we should probably have to rely on conventional ambulances and hospital trains. We are now designing an overseas ambulance train that can be adjusted to any gage track. Despite their drawbacks, helicopters possess the unequaled advantage of getting casualties back to mobile surgical or evacuation hospitals with the least possible loss of time, and we know from experience that early operation in the combat area saves lives and minimizes disability. Lives are saved at or near the front, not back in our well-appointed stateside hospitals.

No discussion of evacuation would be complete without mentioning the need for close control of the flow of patient traffic by the senior medical officer in a theater. Sudden changes in the tactical situation may require forward hospitals to empty their beds and send a large number of patients to the rear without advance warning. The theater surgeon must plan for such a contingency by having an adequate margin of available bed space in rear-area treatment facilities. Individual hospitals in the rear, some of them specialized, must be able to regulate their patient intake and outgo if they are to function effectively.

Continual integrated planning should extend on back to station and general hospitals in the communications zone. Here in the United States, we have established the Armed Services Medical Regulating Office to channel returning patients to the proper hospitals.

The best planning and finest mechanical means of evacuation are useless if competent professional personnel are not available to care for our patients. In the final analysis, the true worth of our Medical Service is directly dependent on the professional competence of our physicians, dentists, nurses, and other personnel.

To give you an idea of what the Medical Service is accomplishing, I should like to cite a few comparative figures for Korean and past wars. The cumulative death rate among wounded who reach medical treatment facilities in Korea is 2.4 percent, as against 4.5 in World War II and 8.1 in World War I. Perhaps an even more striking index of our progress is the fact that 87.3 percent of those wounded in action in Korea are returned to full duty, compared with 77.1 percent in World War II. Almost a third of those returned to duty never leave Korea, about 38 percent return to their units from Japan, and the rest are restored to full effectiveness in the States. Only 4.1 percent of those wounded in Korea have been discharged because of disability. Anyone who knows even a little of modern rehabilitation realizes how meaningless that word "disability" has become in recent years.

Patients with disease fare even better. More than 97 percent were returned to full duty in the Far East Command between 1 July 1950 and 28 May 1952. Deaths from disease among the same group were only 0.12 percent. Our record in caring for patients with nonbattle injuries is equally good. In the first year of the conflict, only 1 percent of such patients in Korea died and about 84 percent were returned to duty in the Far East Command alone. Only about 10 percent of our neuropsychiatric patients in Korea need be evacuated to the States.

BOOKS RECEIVED

The 1952 Year Book of Radiology (June 1951-June 1952), Radiologic Diagnosis, edited by *Fred Jenner Hodges*, M. D., Professor and Chairman, Department of Roentgenology, University of Michigan; and *John Floyd Holt*, M. D., Associate Professor, Department of Roentgenology, University of Michigan. Radiation Therapy edited by *Harold W. Jacox*, M. D., Professor of Radiology, College of Physicians and Surgeons, Columbia University; Chief, Radiation Therapy Division, Radiologic Service, Presbyterian Hospital, New York, N. Y., and *Vincent P. Collins*, M. D., Professor and Chairman, Department of Radiology, Baylor University, College of Medicine; Radiologist-in-Chief, Jefferson Davis Hospital, Houston, Tex. 416 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publisher, 1952. Price $7.50.

Diseases of Metabolism, Detailed Methods of Diagnosis and Treatment, edited by *Garfield G. Duncan*, M. D., Director of Medical Division, Pennsylvania Hospital; Clinical Professor of Medicine, Jefferson Medical College, Philadelphia, Pa. With contributions by 20 doctors. 3d edition. 1,179 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1952.

Electrocardiography in Practice, by *Ashton Graybiel*, M. D., Captain, MC, USN; Director of Research, U. S. Naval School of Aviation Medicine, Pensacola, Fla.; *Paul D. White*, M. D., Executive Director, National Advisory Heart Council; Consultant in Medicine, Massachusetts General Hospital; *Louise Wheeler*, A. M., Executive Secretary, the Cardiac Laboratory, Massachusetts General Hospital; and *Conger Williams*, M. D., Instructor in Medicine, Harvard Medical School; Associate Physician, Massachusetts General Hospital. 3d edition. 378 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1952.

Practical Dermatology, For Medical Students and General Practitioners, by *George M. Lewis*, M. D., F. A. C. P., Professor of Clinical Medicine (Dermatology), Cornell University Medical College; Attending Dermatologist, The New York Hospital; Secretary, the American Board of Dermatology and Syphilology. 328 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1952.

A HOSPITAL TUMOR REGISTRY

BONITA GODWIN, B. A. (1)

A TUMOR registry is a set of records, dealing with malignant or potentially malignant lesions, compiled to insure a thorough follow-up on each patient and to make available suitable records for physicians interested in research. A good tumor registry is adequately cross-indexed and contains complete, easily accessible information regarding the history, diagnosis, treatment, follow-up, and evaluation of therapy on all patients entered therein. In the past few years an increasing number of hospitals, both military and civilian, have established a tumor registry as an adjunct to their tumor board or tumor clinic. In order to promote adequate, uniform records, certain minimum standards which must be maintained by an approved cancer clinic have been outlined (2).

In September 1949 a tumor registry was established at this hospital to support the work of the tumor board which had been functioning for several years. The needs of the hospital were surveyed and other registries were studied in an effort to set up a system of records which would contain all essential information, but which, at the same time, would not be cumbersome or cause duplication of work by the physicians or the clerical workers. This registry occupies only 80 square feet of floor space, has, so far, been staffed by one secretary, and is located in the laboratory because proximity to the pathologic records is desirable. This has proved to be very satisfactory because cases are accessioned in the registry according to the pathologic diagnosis. When no pathologic diagnosis is available, the case is labeled "clinical" so that it may be dealt with accordingly by those who study it. Routinely, all current pathologic reports are screened by the registry secretary and used as a check list to assure the registration of all appropriate cases.

All patients with malignant tumors, other lesions which the physicians desire to follow, and rectal polyps are entered in the tumor registry. Benign tumors which are known to have no significant malignant potentialities are excluded because of the nature of the registry and because follow-up letters written to a patient with a benign tumor might cause him to become unduly apprehensive.

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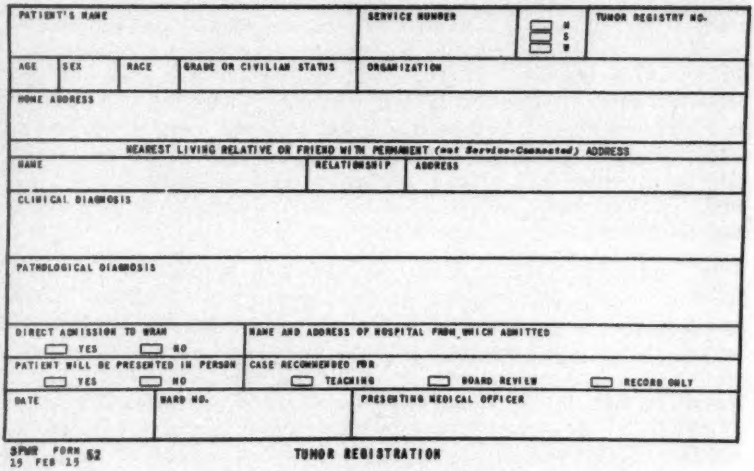
(1) Secretary, Tumor Registry, Walter Reed Army Hospital, Washington, D. C.

(2) Minimum standard for cancer clinics. Bull. Am. Coll. Surgeons, Dec. 1951. p. 392.

In accordance with the standards of the American College of Surgeons, the tumor board at this hospital is composed of the chiefs of the dental, laboratory, medical, radiologic, and surgical services. The chief of the laboratory service serves as president of the tumor board, and the permanent board members, with the exception of the chief of the dental service, rotate as chairman at the meetings. The secretary of the tumor registry acts also as secretary to the tumor board. Regular


PATIENT'S NAME | SERVICE NUMBER | USN | TUMOR REGISTRY NO.

AGE | SEX | RACE | GRADE OR CIVILIAN STATUS | ORGANIZATION

HOME ADDRESS

NEAREST LIVING RELATIVE OR FRIEND WITH PERMANENT (not Service-Connected) ADDRESS

NAME | RELATIONSHIP | ADDRESS

CLINICAL DIAGNOSIS

PATHOLOGICAL DIAGNOSIS

DIRECT ADMISSION TO WRAH ☐ YES ☐ NO | NAME AND ADDRESS OF HOSPITAL FROM WHICH ADMITTED

PATIENT WILL BE PRESENTED IN PERSON ☐ YES ☐ NO | CASE RECOMMENDED FOR ☐ TEACHING ☐ BOARD REVIEW ☐ RECORD ONLY

DATE | WARD NO. | PRESENTING MEDICAL OFFICER

SPMR FORM 52
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TUMOR REGISTRATION

Figure 1. Tumor registration card.

tumor board conferences are held weekly and special meetings are called if a patient's condition demands an immediate decision. Attendance of all medical officers at the conference is expected and free discussion of cases is encouraged. Only members of the tumor board and the chief of the section presenting the patient may vote on the disposition of a patient, and a majority rules. Abstracted proceedings of the conferences are compiled in the form of minutes. The recommendations of the board are prepared in duplicate; one copy becomes a part of the patient's permanent record and one is retained in the registry. A patient may be presented to the tumor board as often as his changing condition indicates.

To register a case, the physician caring for the patient submits a completed tumor registration card (fig. 1) to the secretary of the registry. Most of the information on this card can be obtained from the patient's chart, but it is often necessary to contact the patient and ask for the name and address of some rela-

tive or friend with a permanent address who would, at all times, know the whereabouts of the patient. This is especially important in attempting to follow service personnel whose addresses are usually relatively temporary.

In this hospital, a case entered in the registry may be placed in one of three categories: "Teaching," "Board Review," or "Record Only." It is the responsibility of the ward officer, working with his chief of service, to classify his cases properly. If a patient has a rare type of tumor, has followed an unusual course, or would be particularly instructive, his card is entered in the "teaching" section and he is thoroughly worked up for presentation by the ward officer at the weekly tumor board conference. If he presents a diagnostic problem or there is a question as to the treatment of choice, he is presented to the conference as a "Board Review" case for discussion and a decision as to the proper therapy. If he falls into neither of these categories, he is classed as a "Record Only" case, and the ward officer gives the tumor board a concise abstract of the findings in order that they may approve the treatment or make recommendations for further study or therapy. Other than in the mode of presentation and discussion, there is no difference in the treatment or in the recording of these classes of cases. All are followed in the same manner.

On receipt of the registration card, the secretary of the registry, after checking the files to ascertain the pathologic diagnosis, accessions the case and assigns to each patient a tumor registry number. Patients are listed chronologically; the first 2 digits in the accession number indicate the year of registration, e. g., 51-643. Regardless of how often a patient is presented, he retains his original accession number.

A patient's individual folder, filed according to tumor registry number, is set up to contain all information regarding the patient, including his registration card, abstract of presentation at tumor board conference, recommendation of the tumor board, American College of Surgeons' Tumor Record Form, a summary of each hospitalization, irradiation data, correspondence with the patient and with physicians and other hospitals concerning the patient, autopsy protocol, and any other material pertinent to the case.

The master card (fig. 2) is the key to the tumor registry and is filed alphabetically according to the patient's name. There are facilities for flagging the card with varicolored celluloid tabs so that the secretary of the registry can determine at a glance what forms are due on each patient and the status of the follow-up.

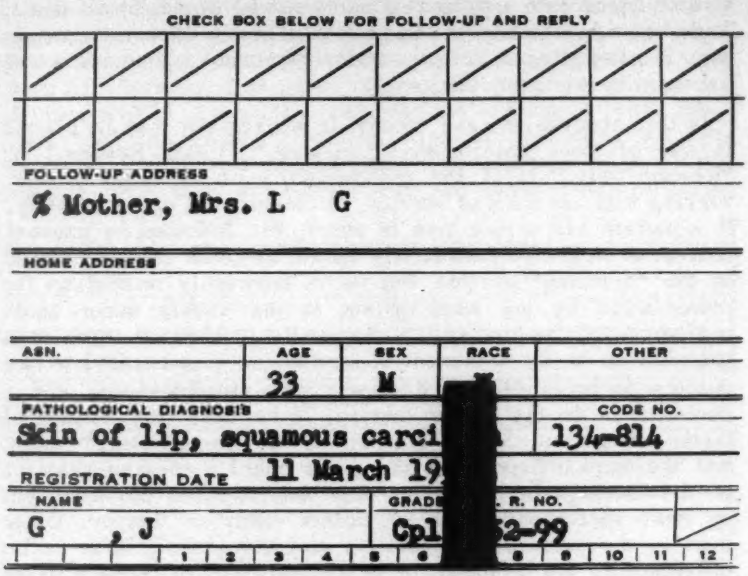

Figure 2. The master file card.

Each case entered in the tumor registry is coded according to the Standard Nomenclature of Diseases and Operations (3). A code file, maintained according to the system outlined by the American Medical Association, is expansible, easily accessible, and wholly visible. Because cases in the tumor registry are cross-indexed in these 3 ways (name of the patient, the disease, and the tumor registry number), material is available for ready reference, regardless of the approach from which it is sought (fig. 3).

Adequate follow-up of patients is the most important purpose of a tumor registry. In order to function effectively, a registry must have the interest and co-operation of physicians, both in the local hospital and in other institutions, the medical secretaries, and the patient. While a patient is under treatment at the hospital, the physician or the registry secretary explains the necessity of a regular follow-up to him or to a member of his family. The patient is made to feel that his co-operation will facilitate the treatment of his own disease and will aid the physicians in the treatment of others with similar conditions.

(3) National Conference on Medical Nomenclature: Standard Nomenclature of Diseases and Operations. 4th edition. Edited by Richard J. Plunkett and Adaline C. Hayden; published for the American Medical Association. The Blakiston Co., Philadelphia, Pa., 1952.

The time interval between follow-up contacts varies according to the type of case and the stipulation of the physician. Though letters of inquiry must, to a degree, be individualized, it is often possible to use form letters. A franked envelope, addressed to the registry, is enclosed with the inquiry. A typical letter asks the patient for his own evaluation of his condition, the date of his last visit to a physician, and the name and full mailing address of that physician. Questions may be as general or specific as indicated by the particular case, and when a physician desires to conduct a special study, the registry assists by distributing special questionnaires to the selected group.

The interest of the hospital staff, as reflected in the work of the tumor registry, is usually appreciated and patient response is generally enthusiastic. The registry, in maintaining contact with the patient, makes him more alert and co-operative, often increasing his chance for survival because, knowing that his condition is of sufficient significance to warrant the continued attention of the physician, the patient is stimulated to watch for symptoms and to seek medical consultation more promptly and freely than he might otherwise.

It is not uncommon to encounter a patient who has been entered in 2 or more registries. In this event, we believe that the follow-up contact should be maintained by the hospital where the pathologic diagnosis of malignancy was established originally. Other registries, in turn, can secure follow-up in-

Figure 3. Walter Reed Army Hospital tumor registry.

formation from that hospital rather than from the patient. If a patient receives letters from multiple registries he may become surfeited with follow-up inquiries and fail to co-operate, or he may become overly alarmed about his condition and develop hypochondriasis.

Uniformity in tumor registry records is desirable. If the needs could be surveyed and the forms standardized, it would be possible for a patient's records to be transferred from one hospital to another without the confusion which often exists now, and the danger of error would be minimized. Furthermore, if tumor registry procedures and forms were uniform, it would enable the physician or the medical secretary, transferred from one installation to another, to work effectively with tumor records, eliminating the period of orientation which is necessary now at each new station. This standardization does not appear to be impracticable because the fundamental needs of tumor registries are the same and the information which is recorded regarding tumor cases is almost universally similar.

Work is now underway to adapt the registry at this hospital to punch cards. This is being done carefully and deliberately and with the realization that the chief problem lies in including all information which will become necessary as cases accumulate, follow-up lengthens, and cancer therapy changes with increasing knowledge. Information sought will necessarily vary somewhat according to the site and type of lesion. Here, especially, would uniformity in tumor registry forms be valuable, for larger series could then be screened with a minimum of time, effort, and expense, whereas, at present, only the cases in an individual hospital are readily available for reports.

A collection of reprints, pamphlets, abstracts, and miscellaneous literature pertaining to tumors is being assembled in conjunction with this tumor registry. This is small and simply organized, but it is proving of value to the physicians and they, in turn, assist in channeling material into this reprint library.

CONCLUSIONS

The value of a tumor registry is in direct proportion to the care exercised by the physician in submitting records. Time spent in furnishing adequate reports to the registry is an investment which pays increasing dividends to the patient and to the physician as the number of cases multiplies and the follow-up period lengthens. Osler's description of the functions of a good hospital might be equally applicable to a good tumor registry as it aids in "the care of the sick, the education of the physician, and the advancement of science."

THE ROLE OF THIAMINE HYDROCHLORIDE IN DENTISTRY

II. Therapeutic Use of Thiamine in Dental Disorders *(1)*

JAMES L. E. BOCK, *Lieutenant Colonel, USAF (DC) (2)*

DENTAL caries. Various theories have been advanced for the cause of dental caries. One cause that has been suggested is malnutrition. Thiamine deficiency has been singled out as one factor in malnutrition which may affect dental caries by producing an acid saliva. Hearman *(113)* suggested that in the absence of thiamine, the normal breakdown of pyruvate, formed during carbohydrate fermentation, does not occur and acid, which results in decalcification at the gingival margins, is liberated. On the other hand, Fancher et al. *(114)*, from extensive tests, concluded that the vitamin stimulated acid formation in saliva and that only vitamin K inhibited acid formation. In one study *(115)* on 41 selected patients with evidence of pellagra, beriberi, and riboflavin deficiency, it was observed that a low incidence of caries and correspondingly low numbers of oral lactobacilli were present. Caries was observed to be inhibited in another group of thiamine-deficient patients *(65)*. Laboratory experiments *(116)* have shown that lactobacilli fail to grow in media without vitamin B complex and that thiamine is essential for some strains of lactobacilli.

Because thiamine and the thyroid gland are such important factors in normal metabolism and growth, an interrelationship between the two which may play a significant part in the structural development of teeth may exist. Rhesus monkeys on which thyroidectomies were performed showed a marked retardation of dentin apposition and later an acceleration of dentin

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(1) Part I appeared in the U. S. Armed Forces Medical Journal, vol. 4, pp. 81-97, Jan. 1953.

(2) Bolling Air Force Base, Washington, D. C.

(113) Hearman, C. D.: Digest of etiology of dental caries. Dental J. Australia 11: 692, Nov. 1939.

(114) Fancher, O. E.; Calandra, J. C.; and Fosdick, L. S.: Effect of vitamins on acid formation in saliva. J. Dent. Research 23: 23-29, Feb. 1944.

(115) Kniesner, A. H.; Mann, A. W.; and Spies, T. D.: Relationship of dental caries to deficiencies of vitamin B group. J. Dent. Research 21: 259-262, June 1942.

(116) Koser, S. A.; and Fisher, B. J.: Vitamin requirement of oral lactobacilli. J. Dent. Research 29: 760-773, Dec. 1950.

apposition in those given thyroxin *(117)*. Eruption of teeth was also observed to be accelerated following the injection of thyroxin in rats *(118)*. The calcification of teeth depends on the normal functioning of the thyroid, and this is influenced to a large extent by the presence of thiamine *(91)*. Peters and Rossiter *(49)* have demonstrated that an increase of thyroid or thyroxin increases the thiamine requirements. Although a high incidence of caries has been observed in both hypothroidism and hyperthyroidism *(119)*, there is inconclusive evidence that thiamine plays a role in the prevention of dental caries. It is generally believed that good nutrition is not as important to the teeth as it is to other organs.

Tic douloureux (trigeminal neuralgia) is a specific type of facial neuralgia affecting the peripheral branches of the trigeminal nerve and is characterized by sudden onset, severe painful spasms, complete freedom from pain between attacks and a trigger zone which, when touched, will usually precipitate an attack. The usual treatment consists of alcohol injection, nerve avulsion, or intracranial section of the posterior sensory root. Alcohol injections are painful and afford only temporary relief. Although surgical procedures give permanent relief, a permanent anesthesia is also produced which in some patients is more disturbing than the original pain.

Borsook et al. *(67)* gave 58 patients with major trigeminal neuralgia 10 mg. of thiamine hydrochloride intravenously daily; 37 showed marked improvement; 15 were moderately improved; 3 showed slight improvement; and 3 showed no improvement. Twenty-five percent of the patients failed to respond to treatment until liver extract was added. The time required for improvement varied from 1 to 6 months after initiating treatment. A patient with tic douloureux successfully treated with massive doses of thiamine is reported below.

Case 1. A 25-year-old nurse reported to the dental clinic on 5 March 1951 complaining of intense pain in the right side of her mandible. She believed that her pain was due to an unerupted, mandibular third molar. Roentgenograms revealed a partially erupted third molar. No pathologic change and no evidence that pressure was being exerted on the adjacent teeth was discernible. Clinical examination failed to reveal any inflammatory process in the area. Six months previously, the patient had experienced a severe spasm of pain in the right side of her face which lasted

(117) Ziskin, D. E., and Applebaum, E. J.: Effects of thyroidectomy and thyroid stimulation on growing permanent dentition of rhesus monkeys. J. Dent. Research 20: 21-27, Feb. 1941.

(118) Kellogg, M., and Eddy, W. H.: Has vitamin B_1 a role in prevention of caries. Dent. Cosmos. 74: 334, Apr. 1932.

(119) See pp. 307-309 of footnote reference *(64)*.

for about 2 minutes. Other such attacks were experienced with increasing frequency over a 4-month period. She was unable to localize the pain because it seemed to affect her eye, upper jaw, and lower jaw. Two months prior to admission, spasmodic attacks of pain were confined to her mandible and instead of periods of complete relief, a constant dull ache in the molar region of her mandible was experienced and persisted without changing in severity. She noted that spasms were frequently induced by brushing her teeth. During the clinical examination with mouth mirror and explorer, a paroxysm was observed when her right mandibular cuspid was touched.

Pain was relieved by an inferior dental nerve injection with 2 percent procaine, but returned in 2 hours with the same degree of pain that was experienced prior to treatment. A diagnosis of atypical trigeminal neuralgia was considered in this case because of the persistent pain existing between acute attacks, but because of the lancinating, painful attacks and the characteristic trigger zone, a final diagnosis of tic douloureux was made. One hundred milligrams of thiamine hydrochloride was injected intramuscularly daily for 14 days. Slight improvement was noted the third day. On the seventh day, the dull ache completely disappeared and the paroxysmal attacks of pain were less frequent. On the tenth day, the patient experienced a slight twinge of pain and thereafter was completely relieved. The pain had not recurred 18 months later.

It is recommended that thiamine hydrochloride be used therapeutically for tic douloureux in all patients before resorting to radical surgical procedures. Even moderate improvement would be better than the permanent anesthesia produced by operation.

Bell's palsy is a paralysis of the peripheral portion of the facial nerve. It may result from trauma, pressure from neoplasms, or infections but more commonly is seen as a result of exposure to cold and drafts. In mild cases, spontaneous recovery is usual in from 1 to 3 months. In more severe cases, especially in those caused from injury, nerve repairs have been accomplished *(120)*. Lerner *(69)* reported 7 patients with peripheral facial paralysis treated with parenteral injections of thiamine. In 5, the disease was of short duration and in 2 it had existed for 9 and 14 years, respectively. Five thousand units (15 mg.) of the vitamin were given daily in most cases, continuing that dose until the lagophthalmos disappeared, and then giving 1,000 units daily until recovery was complete. Partial recovery was noted in from 3 to 5 days with complete cures in from 6 to 18 days. The two patients with chronic disease were markedly improved but not completely cured.

(120) Thoma, K. H.: Oral Surgery. C. V. Mosby Co., St. Louis, Mo., 1948. vol. 2, pp. 1042-1073.

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Neuralgia of the sphenopalatine ganglion of the trigeminal nerve (Sluder's syndrome) is usually treated with cocainization or alcohol injections. Borsook et al. *(67)* reported 4 patients with this syndrome who were given 10 mg. of thiamine hydrochloride intravenously. Two of them were markedly and 2 moderately improved.

Fractures. The treatment of simple fractures of the maxilla and mandible consists primarily of reduction, immobilization, and fixation, but if the fractures are severe or complicated with other injuries, the general condition of the patient is more important than the fixation of the fracture. Shock, hemorrhage, infection, and pain should be controlled before any attempt is made to treat the fracture.

Shock is an acute failure of the peripheral circulation. After a critical point has been passed, progressive anoxia leads to metabolic changes and to damage of such organs as the brain, heart, and adrenals *(81)*. The respiration of liver tissue is severely depressed in shock following hemorrhage. Govier and Greer *(85)*, observed that the survival time of thiamine-treated dogs suffering from shock induced by hemorrhage was from 2 to 4 times that of untreated dogs. In shock produced by hemorrhage in dogs, there is a fall in blood pressure, an increase in blood sugar, and an increase in lactic acid and keto-acids in the blood *(80)*. After thiamine administration, there is a fall in these elevated values, a rise in blood pressure, and an increase in survival time. Treatment of shock consists, in part, of the replacement of the glycogen reserve in the liver and muscles which require an increased amount of thiamine for proper metabolism. Thus, there appears to be a definite indication for the administration of thiamine as part of the treatment of shock.

There is a loss of thiamine in severely damaged tissues *(82)* and in infected tissues *(121)*. There is a decrease in the circulating antibodies in thiamine-deficient rats *(122)*. It is generally believed that a deficiency of thiamine lowers the resistance to disease. Elsom *(123)* noted that patients who preoperatively showed few or no signs of a vitamin deficiency often develop a frank deficiency of thiamine following operation. It would, therefore, appear that thiamine administration would be beneficial in preventing or combating infection in patients with fractures.

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(121) Jolliffe, N.: Handbook of nutrition; conditioned malnutrition. J. A. M. A. 122: 299-306, May 29, 1943.

(122) Carter, B. B., and Axelrod, A. E.: Circulating antibodies in vitamin deficiency states; thiamin and biotin deficiencies. Proc. Soc. Exper. Biol. & Med. 67: 416-417, Apr. 1948.

(123) Elsom, K. O.: Practical aspects of vitamin B deficiency. M. Clin. North America 21: 1229-1244, July 1937.

Although pain is not usually present after a fracture has been reduced and immobilized, neurologic symptoms are sometimes manifested as a result of nerve injury and may take the form of a paresthesia, facial paralysis, or neuralgia. I have observed 7 patients with fractures in whom neurologic signs appeared after the fractures had been fixed. They were given 100 mg. of thiamine hydrochloride daily until the neurologic symptoms disappeared. Five patients with neuralgia, 2 of whom had hypersensitive teeth, were relieved within 20 minutes after the first injection. Pain returned in 2 patients after 24 hours but with less severity and after a second injection the pain did not recur. A paresthesia of the inferior dental nerve in 1 patient with fracture responded to treatment after 3 days. Another patient with fracture, exhibiting a paralysis of the buccal and mandibular branches of the facial nerve and a paresthesia of the inferior dental nerve, required 10 days of thiamine therapy before the neurologic symptoms disappeared.

Because of its diversified physiologic action, thiamine seems to be an important therapeutic and preventive agent in patients with fractures which may be, or may become complicated by shock, infection, or neurologic disturbances. This has been demonstrated clinically and experimentally.

Anesthesia and anoxia. Ether anesthesia produces a moderate increase in keto-acids, blood sugar, and lactic acid *(80)*, and epinephrine stimulates glycogenolysis in the liver *(87)*, thus increasing the thiamine requirements. Thiamine is lost in hemorrhage *(36)* and hemorrhage enhances the action of anesthetics probably as a result of the reduction in the effectiveness of circulatory readjustments together with an already impaired delivery of oxygen to the cells. As a result, cellular respiration and reserve power are reduced and the narcotic level of depression is reached more easily *(124)*. From the standpoint of their effect on the patient's carbohydrate metabolism (and of the diabetic in particular) the order of preference of anesthetic methods according to Blalock *(81)* is as follows: (1) local or block procaine, (2) spinal, (3) cyclopropane and oxygen, (4) ethylene and oxygen, (5) nitrous oxide and oxygen, (6) pentothal by vein, and (7) ether. A patient suffering from thiamine deficiency would seem to be more susceptible to anesthesia and more prone to develop anoxia at an earlier stage than a normal patient. Although the literature does not reveal the clinical application of thiamine in anesthesia, it seems logical that it could be of some value in general anesthesia in raising the cellular respiration of the tissues, particularly those of the brain, and thereby reduce the possibility of anoxia.

(124) Wood, D. R., and Jaco, N. T.: Effect of haemorrhage on anaesthetic dosage. J. Pharmacol. & Exper. Therap. 79: 259-265, Nov. 1943.

Herpes simplex and herpes zoster have been treated successfully with thiamine hydrochloride. Burket and Hickman *(125)* reported 6 patients with herpes simplex, 3 of whom were treated with thiamine hydrochloride and vitamin B complex and 3 with thiamine hydrochloride alone. The oral administration of 5 mg. in a patient with recurrent herpetic lesions resulted in complete resolution. A solitary aphthous lesion was treated with 3 mg. of thiamine daily with complete disappearance in 48 hours. Aphthous lesions appeared in 1 patient every time walnuts were eaten. This patient was cleared of lesion with 3 mg. of thiamine orally within 48 hours. When the same dose was used as a prophylactic measure, aphthous lesions failed to appear after the patient ate walnuts.

Herpes zoster affects the spinal and cranial nerves. The first division of the trigeminal nerve is most frequently involved *(126)*. Rattner and Roll *(127)* reported 16 patients with herpes zoster treated with vitamin B_1 of whom 5 were relieved of pain and 11 were not. They used doses which varied from 1,000 to 2,000 units (3 to 6 mg.) daily. Waldman and Pelner *(128)*, using 100 mg. of thiamine intramuscularly, were more successful. Relief of pain was obtained in 23 patients with from 2 to 6 injections.

Two patients with herpetic lesions were treated with thiamine in the present study. In one, the herpetic lesions appeared after a dental extraction with procaine anesthesia and completely disappeared within 24 hours after 10 mg. of thiamine hydrochloride was infiltrated intraorally. The other patient had a recurrent herpetic stomatitis which had been present intermittently for 2 years. The lesion invariably appeared on the gingiva in the right mandibular cuspid region and was perceptible sometimes as a single vesicle but more often as a cluster of 2 or 3 vesicles. The lesions recurred every 4 to 6 weeks and usually persisted for 2 or 3 weeks. This patient, an extremely nervous 28-year-old woman, had adhered to a severely restricted and inadequate diet for the past few years. Ten milligrams of thiamine was infiltrated intraorally daily in the vicinity of her herpetic lesions. The lesion completely disappeared on the third day. Daily thereafter, she was given multivitamin tablets containing thiamine by mouth. There was no recurrence of her

(125) Burket, L. W., and Hickman, G. C.: Oral herpes (simplex) manifestations; treatment with vitamin B complex. J. Am. Dent. A. 29: 411-418, Mar. 1942.

(126) See p. 152 of footnote reference *(64)*.

(127) Rattner, H., and Roll, H. C.: Herpes zoster and vitamin B_1. J. A. M. A. 112: 2583-2586, June 24, 1939.

(128) Waldman, S., and Pelner, L.: Treatment of essential (idiopathic) herpes zoster by thiamin potentiated with neostigmin. New York State J. Med. 47: 1997-1999, Sept. 15, 1947.

herpetic lesions. Her previous inadequate diet and the disappearance and nonrecurrence of the herpetic lesions following thiamine therapy suggests that her stomatitis was due to a thiamine deficiency.

Hypersensitive teeth. Patients deficient in thiamine show a marked sensitivity of the oral tissues *(65)* and extreme sensitiveness of the teeth to instrumentation and an abnormal thermal response *(129)*. Such conditions have been greatly improved with the use of thiamine. Since 1943 I have used thiamine therapeutically in a large number of patients presenting various pain syndromes. In a substantial number of patients with hypersensitive teeth, the use of thiamine has been observed markedly to reduce sensitivity and in a few has completely relieved the condition. The sensitivity of teeth in most of these patients was due to some operative dental procedure or occurred in conjunction with other dental disorders such as trauma following operation, deep scaling, overhanging fillings, ill-fitting partial dentures, fractures, traumatic occlusion, deep fillings, Vincent's infection, and gingivitis associated with pregnancy. All of these patients were treated with 100 mg. of thiamine hydrochloride injected intramuscularly daily until symptoms were relieved. In most patients one injection was sufficient; rarely a second injection was required. Beneficial results were obtained in from 20 to 30 minutes after injection.

A series of 18 patients with hypersensitive teeth were treated with 10 mg. of thiamine hydrochloride by intraoral injection. In 9, the condition was due to deep scaling or gingivectomy and of these, marked improvement was observed in 3 and complete relief in 6. In 7 patients, hypersensitive teeth followed oral surgical procedures and complete relief resulted from the thiamine injection. Two patients with acute pericementitis caused by traumatic occlusion were treated by occlusal adjustments, but pain and sensitivity were not relieved until thiamine had been administered. Beneficial effects were noted in about 10 minutes after the thiamine injections.

Two patients with acute pericementitis following root canal therapy were relieved by the intramuscular injection of 100 mg. of thiamine in 15 and 30 minutes respectively. Intraoral injections were not used because of the presence of acute inflammation. Hypersensitive teeth associated with a peripheral neuritis of the infraorbital nerve of 4 days' duration in a woman who was 6 months pregnant was observed. Complete relief was obtained in 10 minutes after 10 mg. of thiamine was injected intraorally.

(129) Sinclair, J. A.: Vitamin A and B deficiency—etiologic factor in acute, subacute and chronic Vincent's infection and other dental conditions. J. Am. Dent. A. 26: 1611-1618, Oct. 1939.

The patient was given multivitamins daily by mouth for the remainder of her pregnancy. Pain and sensitivity did not recur.

Whether a general thiamine deficiency or a local deficiency due to injury, trauma, or infection existed in these patients is a matter of conjecture because no blood thiamine determinations were made. It may be surmised, however, that they had a subclinical deficiency and that the various operative procedures were only the exciting factors in further lowering the thiamine concentration which resulted in pain and hypersensitivity. The peripheral neuritis and dental sensitivity in the pregnant woman is believed to have been due to a deficiency brought about by the increased thiamine requirements of pregnancy. Beneficial results have not been obtained in hypersensitive teeth caused by erosion, deep caries, or exposed pulp.

Postoperative pain. Clinical observations were made on the results obtained in 30 patients with postoperative pain when different concentrations of thiamine were parenterally injected in various sites. In 20, intraoral infiltration of 10 mg. of thiamine gave complete relief of pain in an average of 8 minutes and 42 seconds. Pain did not recur in any of these. In 3, intraoral infiltration of 100 mg. of thiamine gave relief of pain in 26, 30, and 30 minutes, respectively. Pain reappeared in 24 hours in 1 patient, but with less severity, and was completely relieved by a second injection. In 2, intramuscular injection of 100 mg. of the vitamin in the deltoid muscle gave relief in 18 and 25 minutes respectively. In 3, injection of 100 mg. of thiamine in the gluteal muscles gave relief in 15, 18, and 30 minutes, respectively. Pain reappeared in 24 hours in 2 of these and a second injection was required. Two patients were given 10 mg. of thiamine intramuscularly in the arm with no apparent effect on the pain. These same 2 patients responded promptly to treatment when 10 mg. of the drug was injected intraorally.

A period of exacerbation of pain, lasting from 30 seconds to 8 minutes, was observed following all intraoral injections. This was more intense and of longer duration when 100 mg. was given than when 10 mg. was used. The degree of increase in pain following the injection appeared to be in direct proportion to the degree of pain experienced prior to injection. There was no exacerbation of pain when intramuscular injections of thiamine were given.

The parenteral administration of thiamine usually gives rise to a moldy or yeasty taste in the tongue. The circulation time of the vitamin, determined by recording the elapsed time between the injection and the appearance of this taste, is from 9.8 to 10.3 seconds when the drug is injected intravenously in the

arm *(130)*. The circulation time following intramuscular injections varies from 30 seconds to 5 minutes, regardless of site. When thiamine is infiltrated intraorally, the circulation time averaged 13.3 seconds. The fact that thiamine is more rapidly absorbed following intraoral infiltration than following intramuscular injection accounts for the quicker beneficial results obtained when the intraoral route is used.

The patients who received 10 mg. of thiamine intramuscularly were unable to detect the characteristic taste. When the same patients were given 10 mg. intraorally, they were promptly able to identify the "thiamine taste." This seems to indicate that a much lower blood thiamine level results from intramuscular than from intraoral injection. For this reason, larger doses of thiamine are required for intramuscular injections to assure a therapeutic concentration.

Paresthesia. Impaired sensation of the trigeminal nerve is a rather common occurrence and may be due to traumatic injury, inflammation, pressure from tumors, edema, local anesthetic injections, fractures, or oral surgical procedures. The degree and duration of paresthesia depends on the extent of injury and may last from a few days to years. Two patients with paresthesia were treated with parenteral administration of thiamine.

Case 2. A 24-year-old man noticed a peculiar, numbing sensation of the buccal mucosa on the left side on 10 February 1952. The area involved was in line with the occlusion of the teeth and about 1 cm. from the corner of his mouth. He felt as though there was a swelling or growth present. The diagnoses considered included psychoneurosis, carcinophobia, leukoplakia, and local irritation from malocclusion. Occlusal equilibration and local medications did not relieve the condition. The paresthesia had existed for 7 weeks when the patient was seen in the oral surgery clinic on 1 April. At this time, no lesion was discernible, the buccal mucosa was normal to inspection and palpation. Ten milligrams of thiamine hydrochloride was infiltrated into the mucobuccal fold in the area of the paresthesia. Normal sensation was experienced in 6 minutes after injection. A slight numbing sensation reappeared on the following day but disappeared after a few hours without further treatment and did not recur. A final diagnosis of paresthesia of the peripheral ending of the buccinator branch of the trigeminal nerve was made.

Case 3. A 72-year-old, edentulous man had a root tip removed from the body of the mandible on the left side on 4 April 1952.

(130) Swenson, R. E.: Parenteral vitamin B as agent for determining arm-to-tongue circulation time. Am. Heart J. 32: 612-616, Nov. 1946.

The root tip was in close proximity to the mental foramen and the mental nerve was injured at the time of operation. The patient was warned that a paresthesia would exist following operation. On 13 May he returned to the clinic complaining of a constant, dull pain in the mandible associated with a numb, tingling sensation of his lip and chin which had been present since the operation. Ten milligrams of thiamine was infiltrated into the mucobuccal fold in the region of his mental foramen. The pain was increased for 30 seconds, but complete relief was obtained in 5 minutes. Partial feeling returned to his lip. He was seen on the following day, at which time normal sensation was present. The pain and paresthesia did not recur.

Dry sockets. One of the most distressing complications that may occur following dental extractions is the dry socket. The symptoms generally set in on the second or third day after the extraction and last for from 10 to 40 days *(131)*. Various drugs, obtundents, and dressings have been used with little success. In spite of the drugs used, pain is only temporarily relieved and the duration of the condition is not shortened to any great degree. Dry sockets do not occur as often today as they have in the past, probably because of improved asepsis and the use of antibiotics and better surgical technic. In spite of all precautions that may be taken by the most skilled operators, however, dry sockets occasionally occur.

Fifty patients with dry socket were treated by the intramuscular injection of 100 mg. of thiamine hydrochloride. Relief of pain was obtained in all patients within from 15 to 30 minutes after injection. No other treatment was instituted until the pain was relieved and then the socket was irrigated with normal saline solution and a dry dressing applied. The dressings were changed daily until the socket was healed. The healing process seemed to be accelerated with the use of thiamine. The pain did not recur in 42 of the patients. In 7, the pain recurred in 24 hours but with less severity and a second injection gave complete relief. One patient required 3 injections before complete relief was obtained, but after each injection the pain was relieved for 24 hours.

Dry socket was more prevalent during the hot, summer months than at any other time of the year. Forty of the 50 cases studied occurred during June, July, and August. The daily high temperature of the locale where these observations were made ranged from 102° to 118° F. Because these patients were all military personnel and presumably consuming the same general diet, it would appear that extreme climatic conditions may be a factor

(131) See pp. 168-171 of footnote reference *(120)*.

in the occurrence of dry sockets. There is experimental evidence of heightened thiamine requirements in tropical heat *(57)*.

One hundred milligrams of thiamine given intramuscularly will relieve the pain in dry sockets in an average of 20 minutes. A study of 11 patients with dry socket was made in an attempt to determine whether similar results could be obtained by injecting smaller amounts of the drug intraorally in the immediate area of the dry socket. Nine were injected intraorally with 10 mg. and 2 with 100 mg. When 10 mg. was used, exacerbation of the pain lasting for from 30 seconds to 2 minutes was experienced immediately after injection. Complete relief was obtained in about 11 minutes. The 2 patients given 100 mg. of thiamine intraorally experienced exacerbation of pain for 5 and 8 minutes, respectively, with complete relief occurring in 26 and 30 minutes. The reason for the increased pain immediately after intraoral injection is not clearly understood. It may be that concentrated amounts of thiamine have a momentary stimulating effect on nerves when injected into areas that have already been overstimulated. Increasing the concentration of thiamine seems to increase the period of pain exacerbation and delays the therapeutic effect. The pain did not recur in any of the patients. The only other treatment given these patients was irrigation and the insertion of dry dressings. The dressings were changed daily until the socket was healed—usually from 3 to 5 days. Ten milligrams of thiamine seems to be sufficient if given intraorally and the results obtained are equal to those obtained with 100 mg. given intramuscularly. The advantages of intraoral injection are: (1) the thiamine can be placed directly in the area of desired action, (2) smaller doses are effective, and (3) quicker relief. The only disadvantage of intraoral injection is the period of increased pain that is experienced immediately after injection.

Temporomandibular joint pain. Two patients with temporomandibular joint pain of 6 and 12 months' duration respectively were treated with massive doses of thiamine hydrochloride. Because of the long duration of pain, appreciable nerve damage had probably resulted and an early response to treatment was not expected.

Case 4. A 28-year-old woman who complained of temporomandibular joint pain of 12 months' duration was referred to the oral surgery clinic on 4 April 1952. The onset was associated with a difficult pregnancy and recurrent attacks of gallbladder disease for which a cholecystectomy had been performed. Her symptoms on admission were the joint pain, burning sensation of the tongue, tinnitus, muscular tenderness and weakness, backache, anorexia, nervousness, dysmenorrhea, mental depres-

sion, and general lassitude. A roentgenogram revealed excessive mobility of the right mandibular condyle when her jaws were open. She had had periodontal treatment, occlusal equilibration, and had worn a bite-raising appliance. Her history and symptoms suggested a possible thiamine deficiency.

Treatment consisted of the daily intramuscular injection of 100 mg. of thiamine hydrochloride. Ten injections were given and then the patient was given multivitamins by mouth. The intramuscular injections were stopped because she was unable to continue the daily visits to the clinic. Her general symptoms were markedly improved after 10 days of treatment. She felt better physically, her appetite increased, her backache and muscular tenderness disappeared, housework was accomplished without excessive fatigue, and a menstrual period was less painful than usual, but the oral symptoms had not changed to any extent.

It is possible that this type of pain will not be relieved by thiamine because of the continued irritation resulting from the hypermobility of the mandibular condyle against the articular eminence. Thiamine has a stimulating effect on muscle *(58)* and retards muscular fatigue. Because there was evidence that this patient was deficient in thiamine, it was thought that this deficiency might have been a factor in causing the joint pain associated with muscular weakness and tenderness. The drug was given not only to relieve the pain, but to stimulate and strengthen the muscles of mastication and thereby aid in reducing the hypermobility of the mandibular condyle. The patient is still taking the vitamin by mouth but the prognosis is not as good as it would have been if parenteral administration could have been continued longer.

Case 5. A 26-year-old woman was referred to the oral surgery clinic because of temporomandibular joint pain. She had had acute rheumatic fever in 1946. In September 1951 she developed diabetes mellitus which was controlled by 10 units of insulin daily. In December she developed a right otitis media which was accompanied by pain in the preauricular region. Consultation with an eye, ear, nose, and throat specialist resulted in the removal of a "tumor" by the use of radium seeds, following which the otitis media was cleared but the pain increased in severity and deafness, tinnitus, a clicking noise when the mandible was depressed, and a pain behind the ear and in the temporal region (but most severe in the joint itself) developed. The pain was described as a constant, boring, dull ache with exacerbations occurring several times daily. The patient had had no relief since the onset. Treatment had consisted of diathermy and the daily oral administration of vitamin B complex. Roentgenographic examination revealed no abnormalities.

A diagnosis of peripheral neuritis of the auriculotemporal and masseteric branches of the mandibular nerve and degenerative changes of the auditory nerve as a result of otitis media and radium treatment was made. In spite of the patient having had vitamin B complex by mouth without beneficial results, daily intramuscular injections of 100 mg. of thiamine hydrochloride were started on 16 April 1952. On the fourth day of treatment the intense pain began to subside. It became intermittent on the fourteenth day and was completely relieved on the twenty-second day. The injections were continued for an additional week, at which time 30 injections had been given. All neurologic symptoms were relieved completely with the exception of the deafness and this has been markedly improved.

This case is another example of the beneficial effect that thiamine has on diseased and injured nerves when administered parenterally in adequate doses. It also demonstrates the ineffectiveness of oral administration. Although therapeutic results have been obtained by the oral administration of thiamine, it has not proved to be as effective as parenteral administration.

Trismus is tonic spasm or rigidity of the muscles of mastication which interferes with the normal opening of the mouth and usually is the result of injury, trauma, or inflammation involving the teeth and the surrounding soft tissues. Dry sockets, pericoronitis of third molars, and fractures are the most common causes. The usual treatment consists of the removal of the cause and the use of hot, moist applications to aid in muscular relaxation. Response to this type of treatment is slow and the patient obtains little or no relief until acute tissue reactions have subsided. Even then, trismus may persist to a certain degree, or a false ankylosis may result from the inflammatory changes in the muscles and soft tissues *(132)*. Meanwhile, the patient is unable to masticate food and is extremely uncomfortable.

Thiamine is beneficial in retarding muscular fatigue and preventing muscular contractions when the associated nerve has been stimulated *(58, 133)*. With the foregoing facts in mind, the effect of thiamine on a series of 9 patients with trismus was observed. In 8, the trismus followed surgical removal of teeth and in 1 it was associated with pericoronitis of a mandibular third molar. Ten milligrams of thiamine were infiltrated intraorally in 5 patients; 100 mg. was infiltrated intraorally in 2; and 100 mg. were given intramuscularly to 2 in whom inflammation

(132) Mead, S. V.: Diseases of the Mouth. 5th edition. C. V. Mosby Co., St. Louis, Mo., 1940. pp. 728-732.

(133) Smith, J. A.; Foa, P. P.; and Weinstein, H. R.: Curare-like action of thiamine. Science 108: 412, Oct. 15, 1948.

and edema prevented intraoral injection. Muscular relaxation was observed in all patients after from 4½ to 25 minutes. The quickest response was obtained by intraoral injections. Muscular relaxation occurred simultaneously with pain relief when 10 mg. of thiamine was injected intraorally and when 100 mg. was injected intramuscularly. In both patients given 100 mg. intraorally, muscular relaxation was observed in 15 and pain relief in 30 minutes. The average elapsed time for the group was 13 minutes. A typical case is reported.

Case 6. A 35-year-old woman was seen in the dental clinic on 23 April 1952. Her maxillary right first and second molars were extracted under 2 percent procaine. The fracture of 3 roots necessitated the making of a flap and removal of some cortical bone. Extirpation of the root tips was accomplished with a minimum amount of trauma. The patient was comfortable until the following morning when she noted pain, swelling, and inability to open her mouth. The pain persisted throughout the day and night and was not relieved with aspirin. She returned to the clinic on 25 April for postoperative treatment. Examination revealed (1) normal healing of the site of operation with no apparent infection, (2) slight edema of the soft tissues on the right side of her face, and (3) acute trismus. Her temperature was normal. She complained of severe pain in the right maxilla which seemed to radiate into her temporomandibular joint. Ten milligrams of thiamine was infiltrated in the mucobuccal fold in the region of the maxillary tuberosity. Exacerbation of pain was experienced for 1 minute, but complete relief of pain and trismus was obtained in 4½ minutes. The patient had the impression that the swelling had subsided, but no change in the edema could be discerned objectively. Her pain and trismus did not recur.

Mechanism of action of thiamine. Shub *(134)* used thiamine parenterally to relieve labor pains. He found that it strengthened the uterine contractions and cut the duration of labor in half. He suggested that thiamine retards muscle fatigue by stimulating the deposit of glycogen in the muscles and by inhibiting the formation of lactic acid and pyrotartaric acid. Stone *(135)*, in using intraspinal injections of thiamine in poliomyelitis, observed a rapid restoration of normal strength in weakened muscles and attributed these beneficial effects to a restoration of the normal cell metabolism in neurons of the spinal cord. Smith et al. *(133)* demonstrated in animals that toe contractions resulting from stimulation of the isolated sciatic nerve are prevented by both

(134) Shub, P.: Thiamin for painless labor. Am. Rev. Soviet Med. 4: 476, 1947.
(135) Stone, S.: Treatment of anterior poliomyelitis. Report on intraspinal administration of pyridoxine and thiamine hydrochloride and artificial fever therapy. Arch. Pediat. 66: 443-461, Oct. 1949.

thiamine and dextro-tubocurarine, although the muscle will still respond to direct stimulation. Thus, they described the action of thiamine as being "curare-like."

Trismus, which in reality is an intensified muscle contraction, may be described as a state of unbalance between thiamine and acetylcholine. Thiamine, but not cocarboxylase, has an inhibitory effect on acetylcholine *(23)*. In maintaining this balance, thiamine is continously used up and must be replaced from other sources because the nerve cell is unable to synthesize this vitamin. Stimulated nerves liberate amounts of thiamine many times greater than those given off by the nerves at rest *(22)*. Acetylcholine is also liberated on nerve stimulation but to a greater extent than thiamine *(23)*. Injury, trauma, and inflammation impair the nutritional influence of the nerve cell, permitting thiamine to diffuse and allowing acetylcholine to exert its affect on muscle. The breakdown of adenosine triphosphate is the primary energy source for muscle contraction *(59)* and acetylcholine accelerates decomposition of adenosine triphosphate, thus intensifying muscle contractions *(136)*. Until thiamine is replaced in sufficient concentration, muscular contractions persist.

It must be replaced in sufficiently high concentrations to counteract the effect of acetylcholine *(136, 137)* because in low concentrations it aids in the synthesis of acetylcholine *(138)* and intensifies the muscle contractions. This is because the breakdown of adenosine triphosphate, by decreasing the concentration of thiamine, stimulates the formation of cocarboxylase *(23)* which catalyzes the decarboxylation of pyruvic acid into acetic acid *(22)*. Acetic acid plus the enzyme cholineacetylase forms acetylcholine *(138)* and thus intensifies the action of the acetylcholine. Thiamine in high concentrations inactivates acetycholine with the aid of cholinesterase.

If this explanation of the muscle chemistry involved in trismus is to be accepted, it is seen that the oral administration of thiamine is of little or no value in its treatment. In fact, in the initial phases of oral administration, the muscular contractions would be intensified instead of being relieved. Therefore, in the treatment of trismus, parenteral administration of adequate doses of thiamine is indicated. Ten milligrams of thiamine for intraoral injection and 100 mg. for intramuscular injection are believed to produce sufficiently high blood levels.

(136) Torda, C., and Wolff, H. G.: Effect of thiamine on striated muscle. Proc. Soc. Exper. Biol. & Med. 56: 89-91, June 1944.

(137) Sadhu, D. P.: Influence of thiamine on action of acetylcholine on muscle. Am. J. Physiol. 147: 233-236, Sept. 1946.

(138) Torda, C., and Wolff, H. G.: Effect of vitamin B_1 and cocarboxylase on synthesis of acetylcholine. Proc. Soc. Exper. Biol. & Med. 56: 88-89, June 1944.

The clinically observed muscular relaxation in one-half of the time required for relief of pain when 100 mg. of thiamine was injected intraorally may be attributed to the difference in the mechanism of action in muscle chemistry and nerve chemistry when high concentrations of thiamine are locally injected. The nerve seems to be irritated or overstimulated temporarily, which delays relief, but inhibition of the acetylcholine effect in muscle is enhanced rather than delayed.

BOOKS RECEIVED

Advances in Internal Medicine, edited by *William Dock*, M. D., Long Island College of Medicine, Brooklyn, and *I. Snapper*, M. D., Mount Sinai Hospital, New York, N. Y. Volume V. 464 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1952.

Lillie's Development of the Chick, An Introduction to Embryology, revised by *Howard L. Hamilton*, Associate Professor of Zoology, Iowa State College, Ames, Iowa. Advisory Editor, *B. H. Willier*. 3d edition. 624 pages; illustrated. Henry Holt & Co., New York, N. Y., publishers, 1952. Price $8.50.

Psychology of Physical Illness, Psychiatry Applied to Medicine, Surgery, and the Specialties, edited by *Leopold Bellak*, M. D., Clinical Assistant Professor of Psychiatry, New York Medical College, Flower and Fifth Avenue Hospitals, New York, N. Y. 243 pages. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price $5.50.

Psychiatric Aide Education, by *Bernard H. Hall*, M. D., *Mary Gangemi*, R. N., Litt. M.; *V. L. Norris*, A. B.; *Vivienne Hutchens Vail*, A. B., P. A.; *Gordon Sawatsky*, A. B., P. A. The report of an experiment conducted by the Menninger Foundation in cooperation with The Topeka State Hospital under a grant from the Rockefeller Foundation, Topeka, Kans. The Menninger Clinic Monograph Series, No. 9. 168 pages. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price $5.75.

The Biochemistry of Gastric Acid Secretion, by *Edward J. Conway*, M. D., D. Sc., F. R. S., Professor of Biochemistry and Pharmacology, University College, Dublin, Ireland; Honorary Fellow, Royal College of Physicians, Ireland. Publication Number 119, American Lecture Series. A Monograph in the Bannerstone Division of American Lectures in Biochemistry and Biophysics. Edited by *W. Bladergroen*, Ir. (DELFT), M. A., Ph. D., Sandoz, Ltd., Basle, Switzerland. 185 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $6.50.

Nutrition and Diet in Health and Disease, by *James S. McLester*, M. D., Professor of Medicine Emeritus, University of Alabama and *William J. Darby*, M. D., Ph. D., Professor of Biochemistry and Director of the Division of Nutrition, Vanderbilt University. 6th edition. 710 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1952.

ISOLATED DISLOCATION AND FRACTURE-DISLOCATION OF THE BASE OF THE FIFTH METACARPAL BONE

JAMES P. AHSTROM, Jr., *Lieutenant, MC, USNR (1)*

ISOLATED dislocation of the base of the fifth metacarpal is so infrequent an injury that it is not mentioned in most textbooks. The earliest known record of such a lesion was made by Tuckerman *(2)* in 1879. Since that time others *(3-9)* have described this condition. Cotton *(10)* also mentioned the injury in 1910, but his account consisted chiefly of a sketch showing the appearance of a hand which had suffered a dorsoulnar dislocation of the base of the fifth metacarpal. Assuming that Deutschlander *(11)* reported only 1 case, the entire number in the literature to date is only 19. Of these, 7 were reported in foreign literature *(11-15)*. Because Tuckerman's report was unavailable, only 11 of the cases reported in the English journals were reviewed.

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(1) Orthopedic Service, U. S. Naval Hospital, Oakland, Calif., at time of writing; now at the U. S. Navy Recruiting Station, Office of Naval Officer Procurement, San Francisco, Calif.

(2) Tuckerman, L. B.: Dislocation of fifth metacarpal bone backward, right hand. Transactions (Youngstown, Ohio) 1: 101, 1879.

(3) McWhorter, G. L.: Isolated and complete dislocation of fifth carpometacarpal joint; open operation. Surg. Clinics, Chicago 2: 793-796, Aug. 1918.

(4) Buzby, B. F.: Palmar carpo-metacarpal dislocation of fifth metacarpal. (Transactions of the Philadelphia Academy of Surgery) Ann. Surg. 100: 555-557, Sept. 1934.

(5) Roberts, N., and Holland, C. T.: Isolated dislocation of base of fifth metacarpal. Brit. J. Surg. 23: 567-571, Jan. 1936.

(6) Murless, B. C.: Fracture-dislocation of base of fifth metacarpal bone. Brit. J. Surg. 31: 402-404, Apr. 1944.

(7) Watson-Jones, R.: Fractures and Joint Injuries. 3d edition. Williams & Wilkins Co., Baltimore, Md., 1943, vol. 2, p. 898.

(8) Clement, B. L.: Fracture-dislocation of base of fifth metacarpal; case report. J. Bone & Joint Surg. 27: 498-499, July 1945.

(9) Hipps, H. E.: Simple isolated dislocation of fifth metacarpo-hamate articulation. U. S. Nav. M. Bull. 45: 945-950, Nov. 1945.

(10) Cotton, F. J.: Dislocations and Joint Fractures. W. B. Saunders Co., Philadelphia, Pa., 1910. p. 383.

(11) Deutschlander, K.: Die isolierte Luxation des V. Mittelhandknochins. Zentralbl. f. Chir. 67: 1393-1399, July 27, 1940.

(12) Hammann: Über die Luxatio carpo-metacarpea. Deutsche Ztschr. f. Chir. 223: 287-296, Mar. 1930.

The base of the fifth metacarpal may be displaced in either of 2 directions. It may lie in the palm anterior to the bases of the third and fourth metacarpals, or it may be displaced in a dorsal and ulnar direction. The first type may be called a radiopalmar and the second a dorsoulnar dislocation. Of the 11 cases reviewed, 5 were of the radiopalmar type and 5 of the dorsoulnar type. The eleventh case was probably a dorsoulnar dislocation *(10)*.

A fracture involving the anteroradial aspect of the base of the fifth metacarpal, and in some patients a large portion of the articulating surface, may accompany dislocation in either direction. Of the 11 cases reviewed, there were fractures in 3. Of these, 2 *(6,7)* were radiopalmar fracture-dislocations and 1 *(8)* was a dorsoulnar fracture-dislocation. Murless *(6)* stated that the fracture could be visualized best in an anteroposterior roentgen projection with the forearm supinated. In the cases here reported, oblique views from either side of the base of the metacarpal were taken as indicated.

Direct trauma to the hand is usually responsible for these injuries. They may result from a direct blow to the ulnar aspect of the hand or from a blow delivered by the injured hand. Waugh and Yancey *(16)* mentioned that Burk attempted to produce isolated dislocations of metacarpals experimentally on cadavers but fractures usually resulted. Dislocations were produced, however, when the anterior and posterior ligaments had been cut. In view of the strength of these ligaments, it may be assumed that these injuries are produced by trauma which is of a severe or, at least, of an unusual nature.

Radiopalmar displacement is probably the result of direct trauma in that direction. If closed reduction is accomplished, it is possible that a dorsoulnar displacement may ensue because of the obliquity of the metacarpohamate joint and the pull of the extensor carpi ulnaris muscle. This secondary displacement is especially likely if a fracture of the base accompanies the dislocation.

Dorsoulnar dislocation is probably caused by several factors. The original trauma causes a tearing of ligamentous structures in the area, thereby loosening the attachment of the base of the

(13) Lusena: Cited by Binotto, A.: Lussazione volare carpo-metacarpica completa. Minerva med. 2: 472-475, Nov. 17, 1940.

(14) Peugniez: Cited by Mittler, L.: Sul meccanismo di produzione di una lussazione antero interna del IV e V metacarpo. Riv. di Chir. 3: 487-491, Oct. 1937.

(15) Valls, J. E., and del Sel, J. M.: Luxacion de la base del 5° metacarpiano (commentarios sobre 3 observaciones). Rev. ortop. y traumatol. 20: 33-39, July 1950.

(16) Waugh, R. L., and Yancey, A. G.: Carpometacarpal dislocations, with particular reference to simultaneous dislocation of bases of fourth and fifth metacarpals. J. Bone & Joint Surg. 30-A: 397-404, Apr. 1948.

bone. If a fracture is also present, the stability of the base of the fifth metacarpal is further decreased. The pull of the extensor carpi ulnaris muscle, which has its insertion on the dorsal and medial aspects of the base, is then responsible for displacement of the shaft and most of the base of the bone proximally, dorsally, and ulnad. This displacement is aided by the

Figure 1 (case 1). Roentgenogram showing fracture of the medial portion of the base of the fifth metacarpal, most of which is displaced proximally and ulnad. Similarity to Bennett's fracture-dislocation of the first metacarpal may be noted.

fact that the metacarpohamate joint line is oblique from its centrodistal to its peripheroproximal point. The resulting roentgenogram in a dorsoulnar fracture-dislocation of the base of the fifth metacarpal is thus similar to that in a Bennett's fracture-dislocation of the first metacarpal (fig. 1).

Treatment of dislocations of the base of the fifth metacarpal has been varied. McWhorter (*3*) and Buzby (*4*) obtained good results with open reduction in 2 patients with radiopalmar dis-

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location, in each of whom the injury was at least 2 weeks old. Watson-Jones *(7)* obtained a good result with open reduction and arthrodesis of a 7-week-old radiopalmar fracture-dislocation. Murless *(6)* reported a good result following closed reduction, and immobilization with a nonpadded plaster splint, of a radiopalmar fracture-dislocation. He attributed his success with closed methods to the fact that the injury was treated immediately. Roberts and Holland *(5)* reported a patient with radiopalmar dislocation, but gave no details regarding treatment or the end result.

Roberts and Holland *(5)* reported 3 patients with dorsoulnar dislocation of the fifth metacarpal. In the first, a 53-year-old man, closed reduction failed and no further treatment was instituted. Five months later, it was estimated that he had 95 percent return of function. In the second, reduction failed. Examination 18 months later revealed weakness of grip on the ulnar side of the hand. In the third, a 31-year-old woman, skin traction was used to maintain the closed reduction, but after 3 weeks redisplacement occurred. Function was reported as good, but the fifth digit had a tendency to drift into ulnar deviation when her hand was relaxed.

Hipps *(9)* treated a patient with dorsoulnar dislocation of the base of the fifth metacarpal by closed methods. He overcame the instability after reduction by maintaining the hand and wrist in a position of radial deviation. As a result, the metacarpohamate joint line was transverse to the long axis of the forearm and the tendency for the fifth metacarpal to slip off the hamate was decreased. The result was good and roentgenographic examination 6 months after treatment revealed maintenance of position.

Clement *(8)* found that closed reduction of a dorsoulnar fracture-dislocation of the fifth metacarpal was easily accomplished, but that when the traction was released the displacement immediately recurred. He was able to maintain reduction by a single Kirschner wire inserted through the proximal thirds of the third, fourth, and fifth metacarpals while the position was maintained manually. When the wire was removed 4 weeks later, there was a full range of painless motion.

Four patients with isolated fracture-dislocation of the base of the fifth metacarpal have been treated at this hospital recently. In all of them, the right hand was involved and the displacement was in a dorsoulnar direction. All of the injuries were closed.

CASE REPORTS

Case 1. Twenty-four hours before his admission to this hospital, a 100-pound bomb dropped on the right hand of a 21-year-old man. There was some swelling and tenderness on the dorsum

Figure 2 (case 1). In the oblique view some dorsal displacement of the fifth metacarpal base may be seen.

of his right hand over the base of the fifth metacarpal, which appeared to be shortened. His fifth digit was in an abducted position and there was pain on motion. Roentgenographic examination revealed a fracture through the base of his fifth metacarpal,

Figure 3 (case 1). Three weeks after open reduction. Position has been corrected. One Kirschner wire has been removed. The remaining Kirschner wire was removed the next day.

with ulnar, dorsal, and proximal displacement of the shaft and most of the base of the bone (figs. 1 and 2). After procaine was injected into his metacarpohamate joint, the fracture-dislocation was easily reduced by manual traction with pressure over the base of the metacarpal. A nonpadded plaster cast was applied but it failed to maintain the reduction. Ten days after injury, the patient was taken to the operating room where the site of injury was exposed. It was found that the small radiopalmar fragment was in reality several fragments, the largest of which was surrounded by an osteoperiosteal shell. This isolated, core-like portion of bone was removed and the dislocation was manu-

Figure 4 (case 2). Postoperative roentgenograms showing reduction.

ally reduced. The position was maintained by means of 2 Kirschner wires through the third, fourth, and fifth metacarpals and further protection was afforded by a volar plaster splint. Twenty-two days after open reduction, the Kirschner wires were removed (fig. 3). Function was complete and the anatomic relationships had been maintained.

Case 2. A man struck his right hand against a post. He noted pain and swelling on the dorsum of the hand and was admitted to this hospital 2 days after injury. The clinical and roentgenographic findings were similar to those of case 1. Six days after injury, an open reduction with internal fixation by crossed Kirschner wires was performed (fig. 4). Thirty-two days after operation, when the wires were removed, the patient had a full range of painless motion.

Case 3. A 21-year-old man injured his right hand while engaged in a fist fight. Three days after injury, he was admitted to this hospital where tenderness and swelling over the dorsal aspect of the base of his fifth metacarpal were noted. Roentgenographic examination revealed a comminuted fracture of the radial portion of the base of his fifth metacarpal. The remainder of the base and the shaft were displaced in a dorsoulnar direction (fig.5). A pressure dressing was kept in place until the swelling subsided and then active motion, within the limits of pain, was allowed. Seven weeks after injury the patient still complained of pain on motion and of tenderness in the area of injury.

Figure 5 (case 3). Roentgenograms showing fracture of the base of the fifth metacarpal and dorsal, ulnar, and proximal displacement.

Case 4. A young man sustained an injury to his right hand while delivering a blow with it. No history of manipulation was obtainable, but his wrist had been immobilized in plaster for 1 month. Because this treatment produced little improvement, a second plaster cast had been applied 3 weeks after the first had been removed. This cast also was left in place for 1 month, at the end of which time the patient resumed his work as a carpenter. Two months later, or almost 5 months after the original injury, he was admitted to this hospital where palpable crepitus on active and passive motion at his fifth carpometacarpal joint was noted. Roentgenographic examination revealed an old fracture at the radial aspect of the base of his fifth metacarpal. The whole base was wider than usual and the medial portion of it was

more proximal and ulnad than normal (fig. 6). Traumatic joint changes were evident. The patient complained of pain in the area of injury on active abduction of the fifth digit, shaking hands, or gripping objects. He also noted that leaning on the heel of the palm caused discomfort. In order to relieve some of the pain, a small fragment of bone was excised from the injured area. Subsequent to this procedure, the complaints were still present but of less severity.

Figure 6 (case 4). Roentgenograms taken after a small piece of bone was removed from the site of injury. Deformity and traumatic changes are evident.

DISCUSSION

There is a noticeable difference in the results obtained in the first 2 as contrasted with the last 2 patients. This may be explained by the fact that anatomic position was not restored in the last 2 and traumatic joint changes developed. The situation is similar to but of less severity than that seen in malunited Bennett's fracture-dislocations of the first metacarpal. Of the 4 medial metacarpals, the fifth has the greatest range of motion and its mobility is necessary to form the concavity of the palm and to maintain an adequate grip. It is desirable, therefore, to maintain a good range of painless motion of the metacarpohamate joint, especially in persons who earn their living by using their hands. Adequate reduction is necessary to restore the proper mechanics and muscle balance following any fracture or dislocation in the hand *(17)*. In patients with long-standing unreduced

(17) Bunnell, S.: Surgery of the Hand. 2d edition. J. B. Lippincott Co., Philadelphia, Pa., 1949. p. 242.

dislocations exhibiting traumatic joint changes, it may be necessary to fuse the joint and thereby obtain relief from discomfort at the expense of mobility. Watson-Jones *(7)* obtained a good result from arthrodesis of the metacarpohamate and the intermetacarpal joints. If an arthrodesis is performed, the concavity of the palm should be preserved by maintaining the fifth metacarpal in a position of flexion.

SUMMARY

A review of the literature has revealed reports of only 19 cases of isolated dislocation of the base of the fifth metacarpal. Of the 12 reported in English, at least 3 were accompanied by fractures, only 1 of which was a dorsoulnar fracture-dislocation of the base of the fifth metacarpal. The proportion of radiopalmar to dorsoulnar dislocations was about equal. A hypothesis to explain the mechanism of injury has been advanced. Treatment in the past has been varied and good results have been reported by both open and closed methods of reduction.

Four patients with dorsoulnar fracture-dislocation of the base of the fifth metacarpal were treated at this hospital. These brought the known total for this specific injury to 5. Of these 4 patients, good results were obtained in the 2 treated by open reduction, and fair or poor results in the 2 treated by other methods.

In order to obtain good results in either dislocation or fracture-dislocation of the base of the fifth metacarpal, anatomic position must be restored. This can usually be accomplished best by open reduction with internal fixation, or by closed reduction with skeletal fixation. When anatomic position is not restored, traumatic joint changes will probably ensue. This is especially likely if a fracture accompanies the dislocation. If the ensuing symptoms are of sufficient severity, it seems best to fuse the joint with the fifth metacarpal in flexion.

BOOK REVIEWS

Manual of Gynecology, by *E. Stewart Taylor*, M. D., Professor and Head of the Department of Obstetrics and Gynecology, University of Colorado School of Medicine, Denver, Colo. 204 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publisher, 1952.

The purpose of this manual is to "provide the medical student and the general physician with the basic essentials of gynecology." In so brief a text, only the essentials can be presented,

hence much historical data has been omitted. A sufficient number of photographs of gross specimens are present but there are very few photomicrographs of histology or pathology. References are given at the end of each chapter, but very little attention is given in the text to experimental work or the pathogenesis of disease. Throughout the text the emphasis has been placed on the medical, psychosomatic, and endocrinologic aspects of gynecology with the understandable omission of gynecologic operations other than their indications and contraindications. The medical and endocrinologic aspects are well presented and the section on infertility is excellent and practical. The last chapter is devoted to hormones, listing many proprietary compounds which the general practitioner will find useful.

—Col, H. E. Harrison, MC, USA

Shock and Circulatory Homeostasis, Transactions of the First Conference, October 22-23, 1951, New York, N. Y., edited by *Harold D. Green,* M. D., Professor of Physiology and Pharmacology, Bowman Gray School of Medicine, Wake Forest College, Winston-Salem, N. C. Sponsored by the *Josiah Macy, Jr. Foundation,* New York, N. Y. 245 pages; illustrated. Printed by Corlies, Macy & Co., Inc., New York, N. Y., 1952. Price $3.50.

The subjects in this report have been well chosen. The humoral vasoactive substances and metabolic derangements in shock are presented by Benjamin Zweifach. This deals with vasodilator material (ferritin) and vasoexciter material and contains a great deal of information about these substances, but little about their application to human problems. Vasoexciter material is the first substance emitted in traumatic and hemorrhagic shock, but appears late after radiation. Ferritin predominates in the early stage following radiation. The mechanism of the enzymatic inactivation of ferritin is described. The role of the nervous system in shock is discussed by John Remington. E. P. Scharpey-Schafer presents the sequence of events associated with acute and chronic hypotension after hemorrhage in man. He also describes the delayed responses after hemorrhage. The infectious element in shock is discussed by Jacob Fine. The chapter by Francis D. Moore on the therapeutic implications of current concepts of shock should be valuable to the clinician. The inestimable value of arterial transfusion in the treatment of shock and the possible mechanisms of its action and the part which the adrenal corticoids play in shock are discussed. The increased amount of the adrenal corticoids required by the organism after trauma is emphasized and the action of the corticoids on the vascular tree is described.

One of the chief advantages of this book lies in its presentation of both sides of certain controversial issues.

—Commander H. A. Lyons, MC, USN

PATHOLOGIC PHYSIOLOGY IN EPIDEMIC HEMORRHAGIC FEVER[1]

GIULIO J. BARBERO, *Captain, MC, USA*
SIDNEY KATZ, *Captain, MC, USA*
HENRY KRAUS, *First Lieutenant, MC, USA*

IN order to evaluate the pathologic physiology of epidemic hemorrhagic fever, experienced observers in forward units in Korea were designated to select patients early in the course of the disease and arrange for their rapid evacuation to this hospital for study by a research group consisting of the authors and 5 technicians. Through this program 20 patients were received in about the third day of their illness. Normal controls were observed and serial and parallel studies were made on each patient. To eliminate bias in laboratory examination, specimens were presented to the laboratory staff without indicating their origin. Furthermore, as many of the determinations as time permitted were performed personally by medical officers of the research group. This article presents the preliminary views on the pathologic physiology of epidemic hemorrhagic fever, as reported at the 1952 Far East Symposium on Epidemic Hemorrhagic Fever in Tokyo.

The diagnostic criteria for the selection of patients for study were (1) characteristic history and physical findings, (2) albuminuria, (3) increased capillary fragility, (4) low specific gravity of the urine, and (5) active diuresis following the acute toxic phase. No attempt was made to evaluate therapeutic measures such as the administration of benadryl or the use of convalescent blood.

The first question raised was: What is the common factor that explains the multitude of signs and symptoms? The most likely answer seems to be that the process is one of capillary damage resulting in increased capillary permeability. The early development of periorbital and conjunctival edema concomitant with or followed by a period of hypotension supports this concept. Also, the hemoconcentration manifested by an increase in the hematocrit reading and the marked edema of the retroperitoneal tissues found at autopsy in patients dying early in the disease indicate that there is some sudden loss of plasma

(1) From the 21st Evacuation Hospital, Korea.

volume early in the acute febrile period. In 40 of 56 patients in whom the spinal fluid was examined, there was an increase in the spinal fluid protein without an accompanying increase in cells *(2)*. It is not known whether this represents a specific reaction of the meninges to the etiologic agent or a direct result of increased capillary permeability in the choroid plexus.

It further appears that capillary damage is not only manifested by increased permeability but that there is injury to the supportive stroma, resulting in an increase in capillary fragility. This toxic change is a primary factor in producing the protean manifestations of this disease. Hemorrhage into any organ or at any site may occur with ensuing clinical findings that depend on where this hemorrhage takes place.

Capillary fragility tests on our patients were performed by several technics. The Rumpel-Leede test was positive in all patients but was found inadequate as a method for serial studies of capillary fragility in the same patient. We therefore used the Dalldorf technic of applying a negative suction of 200 mm. Hg. to an area 1 cm. in diameter over the insertion of the deltoid muscle for 5 minutes and reading the number of petechias after another 5 minutes. By this technic the number of petechias in normal subjects was less than 20. We observed wide variation in the petechial count among normal persons but found that the number observed serially in any such subject remained relatively constant. This was not true in patients with epidemic hemorrhagic fever. These observations led to the conclusion that serial changes observed in any person are more important than any single absolute value. Because of the lack of absolute normal standards we are not prepared to state at what stage in the disease the capillary system develops abnormal fragility nor when it reverts to normal. Our impression is that it becomes abnormal between the fourth and seventh day of the disease concomitant with the appearance of edema, or immediately following it, and reverts to normal usually in the second week, occasionally in the presence of active bleeding.

The next question raised was: How does the increased capillary fragility produce the clinical phenomenon seen? One of the simplest explanations is local trauma. We have observed the development of petechias on the body where it has been grasped in moving the patient, particularly in the axillary folds and sides of the trunk. The petechias of the soft palate and the nasal mucosa as well as the marked hemorrhages of the gastric mucosa appear related to the coughing and retching. The bulbar

(2) This includes findings on a number of patients other than the 20 selected for complete study.

subconjunctival hemorrhages so often reported remained unexplained until one of our medical officers had a severe bout of vomiting, following which he developed massive subconjunctival hemorrhages in both eyes. (He did not have epidemic hemorrhagic fever.) On re-examination of our patients from this point of view we found that in every patient with subconjunctival hemorrhage there was a history of retching, vomiting, or severe coughing. This explanation remained somewhat speculative until we observed 3 patients. The first was free of ocular hemorrhages at the time of examination. Later he began to retch severely and as he lay back following the episode, we watched huge hemorrhages develop in the periphery of the bulbar conjunctiva in both eyes. The other 2 patients also developed subconjunctival hemorrhages following retching—hemorrhages which became larger with subsequent bouts of vomiting. We have also observed the onset of epistaxis with each bout of coughing in several patients. Similarly, coughing and retching, through sudden increase in pressure of the body fluids, may have been a factor in the development of xanthochromic and frankly bloody spinal fluid found in 5 patients. This may be analogous to the development of cerebral hemorrhage from severe coughing in children with pertussis.

If these hypotheses are true, an important addendum to therapy can be made. Sedation with demerol or barbiturates may be of value by diminishing the retching and severe coughing and thus possibly prevent damage to the central nervous system. We attempted to keep our patients well sedated during the acute phase of their illness.

Hemorrhage occurred in a few patients, even in the presence of normal capillary fragility. This caused us to look for some other explanation of the phenomenon. Determinations were made of the prothrombin, coagulation, and bleeding time in our patients. The prothrombin time was found to be normal. Coagulation time was normal as determined by the Lee-White method.

Determination of the bleeding time, however, showed interesting results. The methods used were the Duke technic of stabbing the ear, and the Ivy technic. In the latter, a cuff is placed on the arm, inflated to 40 mm. Hg. pressure and the arm incised to a depth of 2 mm. with a No. 11 Bard-Parker blade. The arm is allowed to hang in a dependent position and the bleeding time determined. Results of the 2 methods were similar. In about one half of our 20 patients the bleeding time varied from slightly above normal limits to 50 minutes. In the rest it was normal. During the acute phase of the disease there was often a marked increase in the volume of blood lost in the test, as distinct from the duration of bleeding time. This was true even

in patients with normal bleeding time. The rather profuse hemorrhage was frequently marked by a sudden cessation of bleeding. The amount of blood lost during any given test seemed to diminish with each day's performance of the test. To our knowledge this is an aspect of bleeding time which has not been well worked out. Our impression is that the bleeding time is abnormal at the same time that capillary fragility is increased and returns to normal slightly before the reversion of capillary fragility to normal.

Because of the bleeding time abnormality, we looked to the changes in the platelet counts as a possible explanation. Even prior to this study we had been impressed with the depression in the platelet count during the initial period of hemorrhage; but knowing the unreliability of all platelet count methods, we decided to repeat all abnormal counts. Parallel controls and both the direct and indirect methods of counting were used. In almost all patients with frank epidemic hemorrhagic fever, the platelet counts were decreased, sometimes to levels as low as 30,000. Serial counts showed an upward trend to normal limits over a 45-day period, paralleling somewhat, but not exactly, the abnormality of the bleeding time. We also noted large platelets about the size of or larger than red blood cells and similar to those found in thrombocytopenic purpura.

No circulating megakaryocytes were seen. Bone marrow studies showed no remarkable changes except for some hyperplasia during the leukemoid phase of the disease. Megakaryocyte counts in the bone marrow were normal.

SUMMARY

Epidemic hemorrhagic fever seems to cause toxic changes in the capillary wall, resulting in loss of plasma into the tissues. This results in edema, hemoconcentration, and hypotension. This is followed by a hemorrhagic phase in which the capillary fragility is increased, the bleeding time is prolonged, and the platelet count decreased. The coagulation time is normal. We found no obvious explanation of why the kidney, the pituitary, and the right auricle are peculiarly susceptible to the hemorrhagic diathesis.

SEQUELAS OF EPIDEMIC HEMORRHAGIC FEVER IN THE CONVALESCENT PATIENT

JOSEPH H. WATSON, *Captain, MC, USA*

THE sequelas of epidemic hemorrhagic fever were studied in 100 convalescent patients—patients in whom the febrile, hemorrhagic, and uremic states had subsided sufficiently so that they could be up and about. On casual inspection these patients appeared quite well, but after an interim history and physical examination were completed, the symptoms and signs shown in table 1 were found to be persisting or recurring.

Fatigue. In this series 89 percent of the patients in the fourth week of disease; 56 percent in the sixth; and 40 percent in the eighth still complained of this symptom. Weakness after walking 3 blocks or less was the criterion used. Typical comments were: "When I walk to the mess (80 yards) I'm too tired to eat"; "I can walk a block, but I feel like lying down after I do"; "I couldn't run if I had to"; and, "I can walk to the PX (350 yards) but I have to stop and rest along the way." This weakness was out of proportion to comparable convalescent phases of other diseases.

Polyuria. Increased urinary output was noted in 78 percent of the patients in the fourth week; 52 percent in the sixth; and 46 percent in the eighth. Average 24-hour quantities were 2,036 cc. in the fourth week; 1,736 cc. in the sixth; and 1,751 cc. in the eighth. An increase in both frequency and quantity was noted. Wide variations of urinary output occur in normal people, but in these convalescent patients it was our impression that the output exceeded that before they acquired epidemic hemorrhagic fever.

Nocturia. In the fourth week patients got up 3 times in the night to urinate; in the sixth and eighth weeks they got up only once. The average specific gravity of urine on one voiding between 0100 and 0500 hours of 10 patients in the sixth week was 1.014 (range 1.007 to 1.025).

Pain in the orbital area. Aching in, behind, and above the eyes occurred in 83 percent of the patients in the fourth week;

in 41 percent in the sixth; and in 33 percent in the eighth. This pain was precipitated or aggravated by using the eyes (reading, occupational therapy, et cetera, in 72 percent). Ophthalmologic examination failed to reveal any abnormalities. Visual acuity, in fact, seemed to be above average, 20/15 being the rule.

TABLE 1. *Symptoms and signs found in patients convalescing from epidemic hemorrhagic fever*

Symptoms:	*Significant laboratory findings:*
Common: Fatigue; Polyuria; Nocturia; Pain in orbit; Blurred vision; Photophobia	Common: Hyposthenuria (Fishberg concentration test); Diminished phenolsulfonphthalein excretion
Uncommon: Anorexia; Abdominal pain	Uncommon: Elevated serum nonprotein nitrogen; Abnormal ECG's
Signs:	
Tenderness in costovertebral angle	
Trembling and nervousness	
Failure to regain weight	

Blurred vision was sporadic and difficult to evaluate, but in the fourth week 87 percent of the patients and in the sixth week, 38 percent complained of this symptom, no cause for which was ascertained.

Photophobia. In the fourth week 87 percent of the patients and in the sixth week, 35 percent described either ocular discomfort or actual pain on being exposed to bright light, as in walking from the ward outdoors on a sunny day.

Anorexia. In 82 percent of the patients, a full or even voracious appetite had returned by the sixth week. The rest could eat, but had no interest in food.

Abdominal pain was a common symptom during the acute phase. Seventeen percent of the convalescent patients had a recurrence of this symptom, associated with tenderness on palpation. The location was not specific, nor was any obvious cause present.

Tenderness in the costovertebral angle was also common in the acute phase, and persisted into the fourth week in 52 percent of the patients; into the sixth, in 21 percent; and into the eighth, in 8 percent.

Trembling and nervousness. Tremor of the hands and a sensation of nervousness was present in the fourth week in 96 percent of the patients and in the sixth week in 75 percent. In 72 percent, it appeared on attempting to use the hands as in writing. Neurologic examination revealed no abnormalities.

Failure to regain weight. Weight gain was very slow, and by the sixth week 70 percent of the patients had failed to regain their preillness weight. This was difficult to evaluate accurately because scales are few and far between in Korea.

Hyposthenuria. Diminution in the concentrating power of the kidneys began in the acute phase after the first week of illness and extended well into convalescence. The maximal value observed in the fourth and sixth weeks was 1.015 and in the eighth week was 1.020. These values were obtained by the 12-hour Fishberg procedure. In 2 patients, isosthenuria was present 6 weeks after the onset of the disease.

Diminished phenolsulfonphthalein excretion. This test was selected because it is, in the main, a measure of the limitation of tubular excretory function imposed by diminished renal blood flow. The amounts of excretion observed may have been a little high as a result of the use of the entire contents of 1-cc. ampules which actually contained about 1.2 cc. Tests were made every second week, and the average percent excreted in the first 15 minutes after injection was 16 percent in the fourth week; 19 percent in the sixth; and 22 percent in the eighth.

Elevated serum nonprotein nitrogen levels and those of other nitrogenous constituents of the blood are common during the acute phase, but, in general, fall to normal in the transition between the acute and convalescent phases. Average values for serum nonprotein nitrogen were 44.4 mg. per 100 cc. in the fourth week; 39.1 in the fifth; 35.1 in the sixth; 27 in the seventh; and 26 in the eighth. Figure 1 shows average values for maximum concentration in Fishberg test, phenolsulphonphthalein excretion in the first 15 minutes, and serum nonprotein nitrogen levels.

Electrocardiographic abnormalities. One or more ECG's were taken on 45 patients, and in 12 were abnormal. In the acute phase, 6 were due to nonspecific myocardial involvement and 6 to electrolyte disturbance, especially hyperpotassemia. In 2 patients the abnormalities were persistent. One had an S type of intraventricular block and the other had what at first was thought to be hypopotassemic effect, but because of the persistence of T-wave inversion in L_2, L_3, aV_F, V_5, and V_6 long after the patient was eating normally and all blood chemistries were within normal limits, it was believed that the posterolateral

wall ischemic pattern was due to subendocardial hemorrhage in that area.

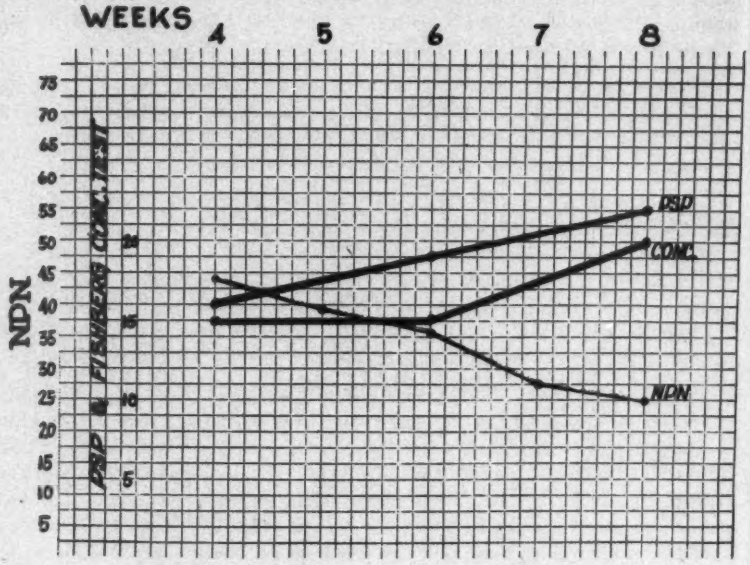

Figure 1. Average values for concentration test, phenolsulfonphthalein excretion and serum nonprotein nitrogen following epidemic hemorrhagic fever.

DISCUSSION

From this study it would seem that easy fatigability extends beyond that of the comparable convalescent phase of other acute diseases. This is probably due to excessive protein catabolism and impaired renal function. The increased protein breakdown is manifested by the high serum levels of nonprotein nitrogen and other nitrogenous waste products, the excessive weight loss, and the retarded weight gain in spite of excellent appetite and adequate calorie intake. Renal damage with impaired excretory function is indicated by hyposthenuria and diminished phenolsulfonphthalein excretion. The damage site would seem to be in the convoluted tubules because it is a decrease in tubular reabsorption rather than in glomerular filtration which causes the increase in urine volume and a decrease in specific gravity.

Photophobia, blurred vision, and ocular pain were common, but as yet no satisfactory explanation has been found. Anorexia and recurrence of abdominal pain was infrequent, but puzzling. Tenderness in the costovertebral angle is probably dependent of swelling of the kidney with capsular stretching, similar to

that occurring in lower nephron nephrosis. Trembling and nervousness are a further indication of the profound somatic disturbance which occurs in this disease. Persistent electrocardiographic abnormalities, most likely due to hemorrhage into the myocardium, were infrequent (2 percent), but showed that lasting cardiac damage may occur.

BOOK REVIEWS

Stereoencephalotomy (Thalamotomy and Related Procedures). Monographs in Biology and Medicine, Volume I, edited by *E. A. Spiegel.* Part I, Methods and Stereotaxic Atlas of the Human Brain, by *E. A. Spiegel,* M. D., Professor of Experimental and Applied Neurology, Head of the Department of Experimental Neurology, Temple University School of Medicine and Hospital, Philadelphia, Pa., and *H. T. Wycis,* M. D., F. A. C. S., Clinical Professor of Neurosurgery, Temple University School of Medicine and Hospital, Philadelphia, Pa. 176 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publisher, 1952. Price $8.

The development of stereotaxic instruments for operations on the human brain is recent. The size and shape of the human skull varies so much in external reference points that dependence on these points for accurate localization of deep structures is unreliable. For example, the authors showed that the pineal gland may be located from 4 to 20 mm. posterior to the interaural plane. Reference points within the brain rather than skull landmarks were selected in devising the human stereotaxic apparatus. Spiegel and Wycis first described a stereoencephalotome in 1947, and since then have produced 2 models with simplification and reduction of its weight to 5.52 pounds.

The experiences of neurophysiologists in the study of the deep ganglia of the brain and the recent advances in psychosurgery, surgery of pain, and the treatment of diseases of the basal ganglia provided the incentive for the development of stereoencephalotomy in humans. The authors have pioneered in this field. Their book describes the calculation of electrode position by means of a reference point determined with a standardized roentgenogram, pneumoencephalograms, and an exact knowledge of the position of the area to be destroyed in relation to the reference point. The apparatus including electrodes, the roentgenogram and operative technics, interpretation and measurement of roentgenograms, and the final calculations are all described in detail.

The atlas is based on a study of 30 brains fixed in situ by intracarotid injection. The photographs are made against a black background printed on a co-ordinate system marked off in milli-

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meters. The center of the posterior commissure is used as a reference point because it is more constant than the center of the pineal gland. Tables of variability are included. For the sake of completeness, the glossary is in Latin, English, German, French, Italian, and Spanish. The authors exercised good judgment in designating the structures in the atlas and in not duplicating the detailed descriptions of anatomy already found in texts devoted to that purpose. References are made to current workers in this field in other countries, but the authors have no personal experiences with the many types of human stereotaxic instruments used by other workers. They do, however, desire further simplification of operative procedures.

This monograph will help to establish operations on the deep structures of the brain on a sounder basis, which will reduce damage to the cortex. The authors present data on over 100 patients on whom they have operated. Their follow-up studies will determine the comparative usefulness of their technic. The method will also clarify some problems in physiology of these deep ganglia in the human brain and help to correlate them with the animal studies.

—*Lt. Col. R. C. Greenwood, MC, USA*

Physiological Bases of Gynecology and Obstetrics, by *S. R. M. Reynolds*, M. A., Ph. D., D. Sc., Dr. hon. causa., Staff Member, Physiologist, Department of Embryology, Carnegie Institution of Washington; Lecturer in Obstetrics, The Johns Hopkins Medical School, Baltimore, Md.; Profesor honoris causa, Facultad de Medicina, Universidad de la República Oriental del Uruguay, Montevideo, Uruguay. 153 pages. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $5.50.

Each chapter in this clearly and concisely written book is presented as an individual lecture. The author presents several new concepts regarding the physiology of the female pelvic organs. Of particular interest to the obstetrician are the chapters on (1) abnormal labor and incoordinate uterine action, (2) uterine growth during pregnancy, and (3) the physiologic conditions in the uterus at the onset of labor.

The gynecologist would be most interested in the chapters dealing with (1) the physiologic basis of menstruation, (2) the ovarian vasculature and ovarian function, and (3) the endocrine effects of hysterectomy.

There is a valuable supplementary reading list at the end of the book. Although this volume might not be of particular interest to the average practitioner, it is highly recommended for all whose whole or partial interest lies in the fields of obstetrics or gynecology.—*Commander G. C. Calderwood, MC, USN*

PATIENT TRIAGE FOR TREATMENT AND EVACUATION[1]

JAMES H. FORSEE, *Colonel, MC, USA* (2)

TRIAGE is the correlation of the time and place of the patient's care with the severity of his disease or injury. It is the first labeling of patients for distribution rather than for evacuation. To evacuate literally means "to empty" and this is not the objective sought in meeting the problems of mass disaster or the casualties of war. Distribution underlies the whole system of evacuation as there is no point in sorting patients unless they are distributed selectively in accordance with their needs. The further one gets from the front in military combat or from the scene of mass disaster, the more important proper distribution becomes. The ultimate triage comes in the establishment of special centers to care for certain types of injury or disease. These distinctions are emphasized because for the first time since the War Between the States, this country is evincing an interest in the possibility of mass disaster at home.

The broad aspects of this subject include problems relating to psychiatry, medicine, discipline, and morale. This article is limited to the more specific problems of military surgery. It is hoped that the lessons learned by our Armed Forces may be readily translated to meet future problems in other fields.

In the forward area, i. e., within the army and more particularly the division area, battle casualties receive needed dressings, splinting, and sedation by trained laymen and are transported to aid stations and clearing stations for further care. The clearing station is the focal point of triage. The degree of urgency of treatment in each case is determined by the nature of the wound and its existent or potential complications. Here casualties are sorted into those that require immediate surgical treatment and those that may be safely transported and distributed to medical facilities further to the rear but within the army area. The distribution of battle casualties of any type to the fixed hospitals and specialized centers of the base area without the benefits of initial treatment occurs under the exigencies of certain tactical situations, such as the early phases of combat on a beach-

(1) Presented at the Deans' Orientation Program, Army Medical Service Graduate School, Washington, D. C., 28 April 1952.

(2) Fitzsimons Army Hospital, Denver, Colo.

head. The use of the helicopter for transporting the wounded from forward areas to hospitals within the army area for initial treatment has been extensively employed in the Korean conflict.

A small, "first priority surgical hospital" is placed immediately adjacent to the clearing station. This is the furthest point forward at which primary surgical operations can be performed (figs. 1 and 2). Here the following essentials can be assured: (1) an experienced group of surgeons, anesthesiologists, and operating room personnel, (2) simple x-ray facilities, (3) simple but adequate operating room facilities, (4) lighting and water supply, (5) reasonable accommodation under shelter (usually tentage), and (6) facilities to retain the more seriously wounded for from 7 to 10 days.

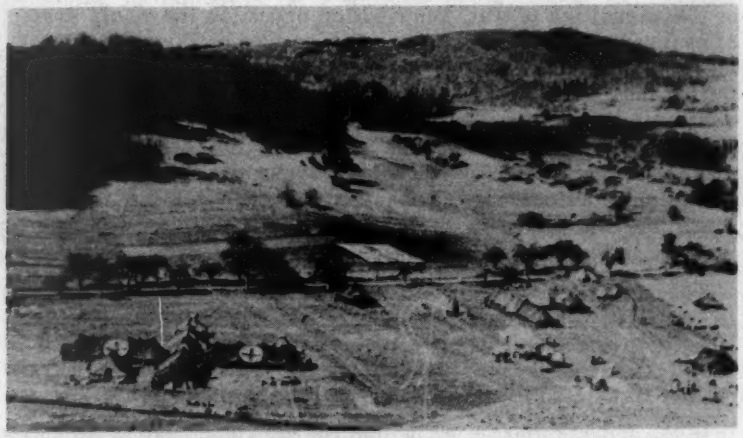

Figure 1. First priority surgical hospital in foreground.

Triage and distribution at this point in the axis of transportation makes its first real appearance. The slightly wounded soldier, certain casualties due to accidents, and patients with certain phases of combat fatigue, exhaustion, or illnesses of short duration may be retained at the clearing station and returned to the front without further distribution to the rear. Operations at a first priority surgical hospital are confined to the most severely wounded whose condition does not permit further transportation to the rear. This group comprises only about 9 percent of all casualties reaching the clearing station. They require treatment for (1) the correction of profound physiologic disturbances that immediately endanger life (such as continued bleeding uncontrolled by first-aid measures, severe shock, chest wounds producing respiratory distress, and maxillofacial wounds with respiratory obstruction) and (2) arrest or prevention of infection

that if allowed to develop would endanger life or lead to grave disability (in patients with abdominal wounds, thoracico-abdominal wounds, suspected gas gangrene, wounds of extremities with impairment of blood supply or transported with tourniquet in place, compound fractures of long bones, and wounds with extensive muscle damage).

Figure 2. First priority surgical hospital operating team.

To preserve the true function of a hospital of this type it is as important to prevent flooding with nonurgent cases as it is to direct to it the flow of proper cases. Less than 5 percent of the most severely wounded admitted to first priority surgical hospitals in the Mediterranean theater were in such poor condition that they could not be restored to a status which permitted operation. No matter what the operative risk, it must be accepted, or the patient is sure to die. A well-run first priority surgical hospital exerts a remarkably favorable effect on the morale of combat troops and their officers. The divisional medical service receives a stimulus to maintain its arduous task by firsthand evidence that the lives of the most desperately wounded may be saved by skillful first-aid measures and rapid distribution. Splinting is improved, the use of plasma in aid stations is increased, and the temptation of clearing stations to indulge in major operations for which they were not designed or equipped is removed.

Certain factual data indicate the significance of proper triage, distribution, and care of the severely wounded. Between 1942 and 1945, the Second Auxiliary Surgical Group (of which I was commanding officer) operated on 3,532 patients for abdominal injury, which represented two-thirds of the total number of casualties suffering abdominal wounds in the entire A. E. F. of World War I. The longer continued bleeding, peritoneal contamination,

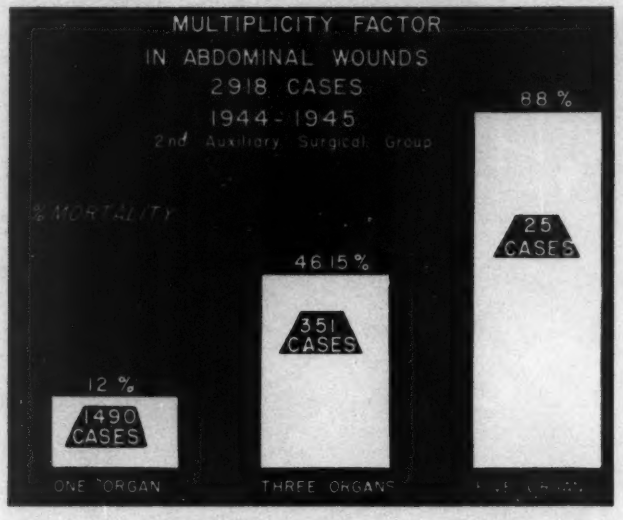

Figure 3.

infection, and profound disturbances of physiology remain uncorrected the more serious is the prognosis. The time lag from injury to operation is influenced by many factors including climate, terrain, distance, road net, availability of airplanes, tactical situation, and medical facilities. The increase in mortality in relation to increased time lag was carefully studied in a group of 2,303 patients with intra-abdominal wounds during 1944 and 1945. In a group of patients with 1 organ injured, the mortality rate for 557 operated on within 8 hours of injury was only 6.8 percent; the rate for 617 treated from 8 to 16 hours after injury was 10.6 percent; that for 142 treated from 16 to 24 hours after injury was 19 percent. That there are other factors in addition to time lag is evident when the degree of severity of the wound as judged by the number of organs wounded is considered. In this same group, 44 patients with 4 abdominal organs wounded and treated within 8 hours of injury had a mortality rate of 52.2 percent. When the interval was increased to from 16 to 24 hours, the mortality was 85.7 percent. This "multiplicity factor" may be further illustrated. In 2,918 patients in whom 1 abdominal

organ, irrespective of which one, was injured, the mortality rate was 12 percent. When 3 organs were injured, the rate was 46.15 percent (fig. 3).

The need for triage and selectivity based on the urgency of the wound is also evident after patients are admitted to the first priority surgical hospital. With increased experience and improved resuscitative measures, the time lag between hospital admission and operation was decreased. In 1944 this interval averaged 4½ hours, but in 1945 it was decreased to 3½ hours. Along with this experience there was a general decrease in mortality, as illustrated in the surgical care of thoracico-abdominal wounds. A reduction of mortality from 36.7 percent in 1943 to 20 percent in 1945 occurred (table 1).

TABLE 1. *Mortality rate in 903 patients with thoracico-abdominal wounds treated in first priority surgical hospital of the Second Auxiliary Surgical Group*

	Total	1943	Jan-June 1944	July-Dec 1944	1945
Patients	903	68	243	392	200
Deaths	247	25	84	98	40
Mortality rate (percent)	27.3	36.8	34.9	25.0	20

In the appraisal of the time lag from injury to operation, from admission to operation, and the selection of patients for operation after admission, several factors warranted careful study. It became apparent that no matter how soon a patient with multiple organs wounded was operated on the mortality rate was very high and the rate increased with additional hours of time lag. In fact, if these severely wounded patients are not operated on early, very few will live. On the other hand, patients with a low "multiplicity factor" have a low mortality rate if operated on early. With additional hours of delay, a gradual but significant rise in mortality rate is noted in this group also. In effect, therefore, a patient with only 1 or 2 organs injured with a long time lag is likely to be in a serious condition, simulating a patient with a high multiplicity factor and a short time lag. For example, a group of patients with 2 abdominal organs wounded and a time lag of 24 hours had a mortality rate of 40 percent and a group with 4 organs wounded and a time lag of 8 hours had a mortality rate of 52 percent.

About 90 percent of the wounded are cared for in the evacuation hospitals. These hospitals require experienced professional staffs including all needed specialties. Their staffs attain a high degree of proficiency in the procedures of initial wound manage-

ment and are the backbone of the Army Medical Service. Early in World War II, observations of the selection of admissions to first priority surgical hospitals and evacuation hospitals based on the surgical urgency of the wound, revealed interesting data which is shown in table 2.

TABLE 2. *Selection for admission based on the surgical urgency of wounds*

Location of wound	Percent of total admissions to	
	First priority surgical hospital	Evacuation hospital
Upper extremities	9.4	26
Lower extremities	35.0	45
Abdomen	20.0	3
Thorax	19.3	9
Other	16.3	17

In the rear areas, base sections, and the hospitals in the zone of the interior distribution based on selection of the wound reaches a high degree. Specialized treatment centers established for amputations, neurosurgery, thoracic surgery, plastic surgery, vascular injuries, et cetera, have been highly successful. Distribution also becomes easier as the distance from the front increases and fewer errors result in getting the patient to the proper center.

CONCLUSIONS

The basic concepts herein presented are adaptable to most situations concerned with the treatment of large numbers of casualties. This presentation is based largely on experience in the North African and Mediterranean Theaters of Operations during World War II. In addition to the official records and publications by members of the Second Auxiliary Surgical Group, the writings of Dr. E. D. Churchill (3-7), formerly the consultant surgeon in the above named theaters, have been freely quoted.

(3) Churchill, E. D.: Theater experience in wounds of abdomen. M. Bull. North African Theat. Op. (No. 3) 1: 2-6, Mar. 1944.

(4) Churchill, E. D.: Modern surgery in combat area with evacuation based on surgical urgency of wound. M. Bull. North African Theat. Op. (No. 3) 1: 7-8, Mar. 1944.

(5) Churchill, E. D.: Trends and practices in thoracic surgery in Mediterranean theater. J. Thoracic Surg. 13: 307-315, Aug. 1944.

(6) Churchill, E. D.: Surgical management of wounded in Mediterranean theater at time of fall of Rome. Ann. Surg. 120: 268-283, Sept. 1944.

(7) Churchill, E. D.: The American surgeon, A. U. S. (Martin memorial lecture). Surg., Gynec. & Obst. 84: 529-539, Apr. (No. 4a), 1947.

ANATOMIC LANDMARKS IN BLOCK ANESTHESIA OF THE INFERIOR ALVEOLAR NERVE

STUART FOULKE, *Captain, USAF (DC)* (1)

THE complaint is often heard that certain local anesthetic solutions do not produce the desired result—that the anesthesia is produced too slowly or that it is not deep enough. In order to develop and maintain a sound local anesthetic technic it is necessary to (1) have a thorough knowledge of the anatomy of the structures involved and (2) be aware of the existence of, and be able to adapt the technic to, individual anatomic variations. The best way to become familiar with the anatomy of the nerves and adjacent structures involved is to dissect cross sections of the head and neck of a cadaver. Because cadavers are not readily available in sufficient numbers, the next best method is to practice on the dry skull.

Because it is impossible to discuss here all of the local anesthetic procedures used in the practice of dentistry, this article will be concerned only with conduction anesthesia or block anesthesia of the inferior alveolar nerve (mandibular block). In a successful technic for accomplishing this, the landmarks used in selecting the injection site must be those that are individually fixed and yet can be correlated with one another in such a way that through their identification and use the operator will be able to circumvent individual anatomic variation. Most of these landmarks are points on the bone of the ramus of the mandible that are felt rather than seen. Some of these points can only be identified by projecting the "palpation" into the depth of the soft tissues by the point of the needle.

LANDMARKS

Using a good source of light and having the patient open his mouth fully, one of the first and perhaps the most outstanding landmark to be sighted is the rounded fold of tissue which appears to form the dividing line between the mouth and throat. This fold of tissue is commonly known as the pterygomandibular fold, buccal fold, or molar fold and appears to connect the tuberosity

(1) Madigan Army Hospital, Tacoma, Wash.

of the maxilla with the retromolar fossa of the mandible (fig. 1). The pterygomandibular fold is formed by the pterygomandibular raphe with an outer covering of mucosa.

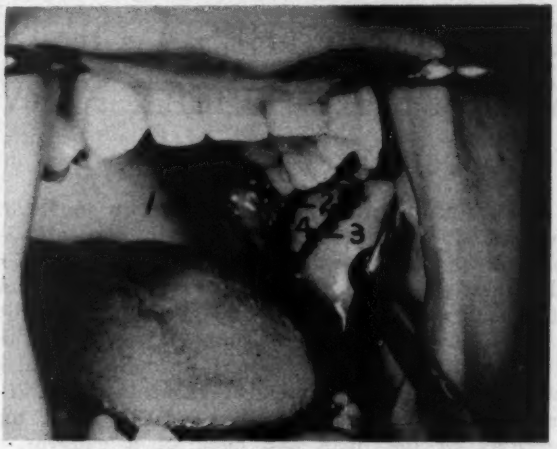

Figure 1. Photograph showing the superficial landmarks in the posterior part of the oral cavity. 1. Pterygomandibular fold. 2. Internal oblique line. 3. External oblique line. 4. Retromolar fossa.

The pterygomandibular raphe is composed of the fascia connecting the superior constrictor muscle on the medial with the buccinator muscle on the lateral aspect and extends from the hamular process of the medial pterygoid plate to the mylohyoid line of the mandible. The anterior border of the internal pterygoid muscle is almost directly posterior to the pterygomandibular raphe. By placing the index finger of the left hand on the pterygomandibular fold, it will be noted that this tissue is easily compressible. By sliding the finger laterally, another landmark is located. This is the internal oblique line, a hard, rounded ridge beneath the mucosa and just posterior and lateral to the third molar tooth. Continuing to move laterally the finger next palpates a shallow depression, the retromolar fossa.

The lateral boundary of the retromolar fossa is formed by a sharp ridge of bone which serves as another easily palpable landmark, the external oblique line. By moving the finger a very short distance laterally, another structure which aids in the orientation of the landmarks previously discussed is found. This is the anterior border of the masseter muscle (fig. 2), a sharp muscular band which may be confused with the bony external oblique line unless its muscular texture is confirmed by having the patient open and close his mouth.

The five landmarks revealed by palpation of the structures discussed above form the basis for a successful orientation of the operator in respect to the surface anatomy of that portion of the posterior part of the mouth concerned with inferior alveolar nerve block (2).

Figure 2. Cross section of head at the level of the mandibular foramen. 1. Inferior alveolar nerve at level of mandibular foramen. 2. Ramus of mandible. 3. Internal oblique line. 4. External oblique line. 5. Masseter muscle. 6. Internal pterygoid muscle. 7. Buccinator muscle. 8. Pterygomandibular raphe. 9. Superior constrictor muscle. 10. Parotid gland.

PRACTICAL APPLICATION

Anesthesia of the lower teeth is brought about by the blocking of the sensory impulses from the inferior alveolar nerve via the mandibular division of the trigeminal nerve in the pterygomandibu-

(2) Seldin, H. M.: Practical Anesthesia for Dental and Oral Surgery. 3d edition. Lea & Febiger, Philadelphia, Pa., 1947.

lar space *(3)* just before it enters the mandibular foramen. The lateral wall of the triangular pterygomandibular space is formed by the inner surface of the ramus of the mandible; its medial wall, by the internal pterygoid muscle; and its roof, by the external pterygoid muscle. The apex of this space points downward, being formed by the attachment of the internal pterygoid muscle to the angle and lower portion of the inner aspect of the ramus of the mandible. Some of the most important landmarks in inferior alveolar nerve block are found in the ridges and grooves of bone on the inner surface of the mandibular ramus *(3)* (figs. 3 and 4).

The insertions of the temporalis and external pterygoid muscles are shown in figure 5. The pterygomandibular raphe lies just anteriorly to the anterior border of the internal pterygoid muscle (fig. 2). This is an important consideration in performing the inferior alveolar nerve injection because we wish to avoid entering the internal pterygoid muscle with the needle. The external pterygoid muscle forms the roof of the pterygomandibular space and is, therefore, of little concern to us during inferior alveolar nerve block because it is so far above the site of injection.

One of the most common misconceptions experienced in determining the location of the surface landmarks is a result of nomenclature. The retromolar fossa, which you would expect to find posterior to the molar teeth, can be shown on the bony mandible to be lateral to the buccal surfaces of the molar teeth (fig. 6). The internal oblique line is also lateral to this plane. After the internal oblique line has been located, it is easy to identify the pterygomandibular raphe a short distance medially (fig. 7). With these two landmarks definitely identified, the point of entry for the needle can be located. Horizontally, this point lies between the pterygomandibular raphe medially and the internal oblique line with its tendinous insertion of the temporalis muscle laterally. If the needle enters either of these structures, resistance is felt, pain is experienced, and the possibility of depositing the anesthetic solution at the wrong site is greatly increased.

Vertically, the plane of injection must be the same as that of the mandibular foramen. This plane may be established by locating the point of least diameter *(4)* between the external oblique line and the posterior border of the ramus of the mandible (fig. 8). The technic involved requires that the patient's mouth be from two-thirds to fully open. Use the index finger or the thumb to palpate the external oblique line to determine the deepest point of its concavity and place the thumb or third finger half way up on the posterior border of the ramus of the mandible,

(3) Sicher, H.: Oral Anatomy. C. V. Mosby Co., St. Louis, Mo., 1949.

(4) Northrop, P. M.: Practical technics in administration of local anesthetic agents. J. Am. Dent. A. 38: 444-448, Apr. 1949.

Figure 3. Internal surface of the ramus of the mandible showing the important bony landmarks. 1. Mandibular foramen. 2. Mandibular sulcus. 3. Lingula mandibulae. 4. Mylohyoid groove. 5. Internal oblique line (temporal crest). 6. Retromolar triangle. 7. Retromolar fossa. 8. External oblique line. Figure 4. Anterior view of the mandible showing the important bony landmarks on the ramus. 1. Internal oblique line. 2. External oblique line. 3. Retromolar fossa.

thus establishing a straight line between these two points. On this plane, the mandibular sulcus and foramen are found about two-thirds the distance from the external oblique line to the posterior border of the ramus.

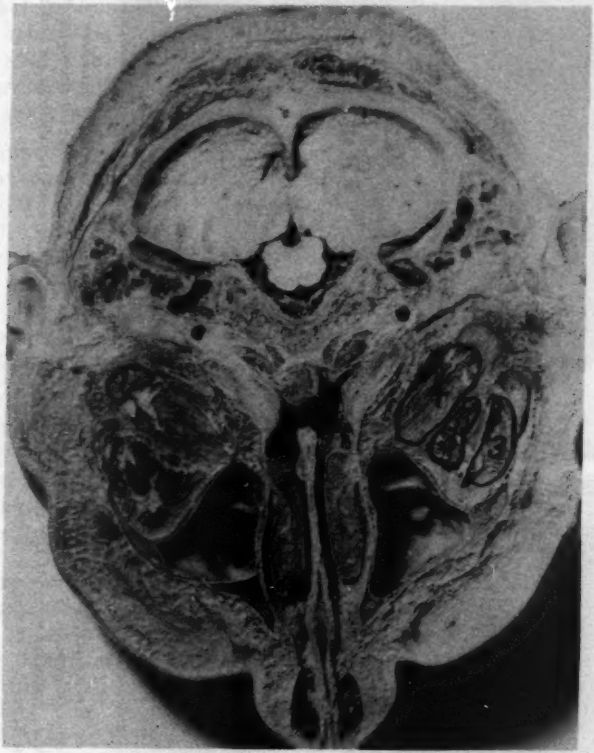

Figure 5. Cross section of head at the level of the head of the mandibular condyle. 1. Head of condyle. 2. Coronoid process. 3. Temporalis muscle. 4. External pterygoid muscle.

Having determined the point of insertion, the technic followed in reaching the mandibular foramen with the point of the needle is a matter of preference. Some operators use a straight, forward advance of the needle from the point of insertion until the foramen is reached and others prefer to follow the contour of the inner surface of the mandibular ramus. In order to produce a satisfactory block, it is necessary to deposit the anesthetic solution in the mandibular sulcus in close proximity to the nerve (fig. 9).

The inferior alveolar nerve does not pass downward in close approximation to the inner aspect of the ramus but follows medi-

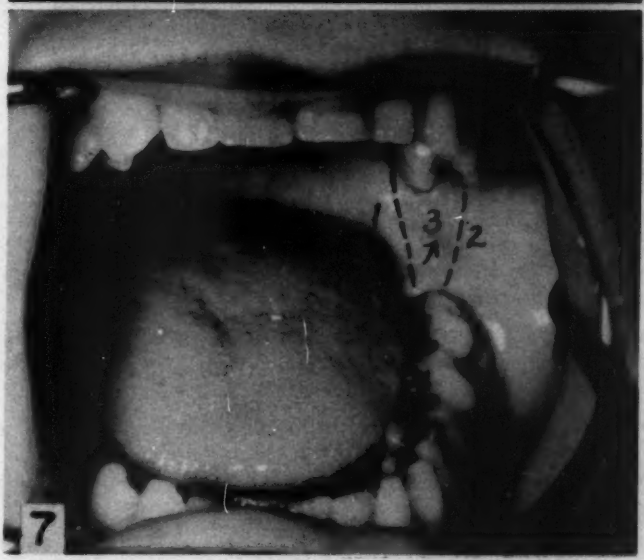

Figure 6. Anterior view of the mandible showing the retromolar fossa and the internal oblique line to be lateral to the plane formed by the buccal surfaces of the molar teeth. Figure 7. Photograph showing superficial landmarks and the point to be considered for entry of the needle. 1. Pterygomandibular fold. 2. Internal oblique line. 3. Point of insertion.

ally to the external pterygoid muscle (fig. 10). At its lower border it turns outward at almost a right angle to the mandibular sulcus and does not touch the ramus except in the sulcus proper. Mandibular ramuses vary significantly in width, i. e., distance from anterior to posterior border, in angulation, and in length

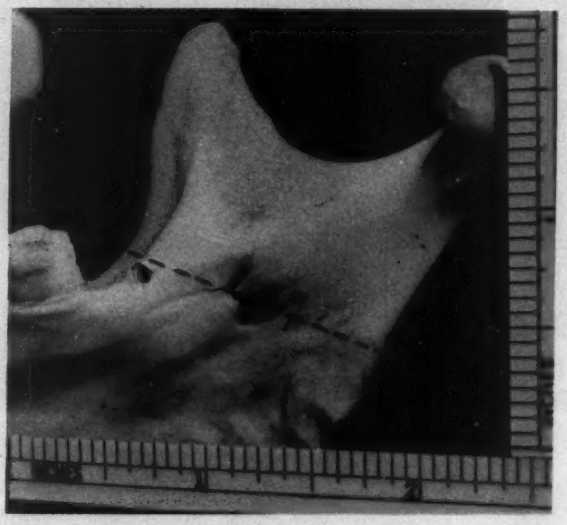

Figure 8. Internal surface of the ramus of the mandible showing the mandibular foramen to be located vertically on the plane of least diameter (dotted line).

(fig. 11). For this reason, inferior alveolar nerve block technic must be based on certain definitely located landmarks, with due allowances for individual variation, rather than an arbitrary system of distances and angles.

Inadequate anesthesia may result from injecting the anesthetic solution too high, too low, too far medially, or before reaching or after passing the mandibular foramen.

Trismus and pain in swallowing and masticating may result from injecting too high (external pterygoid muscle), too low (internal pterygoid muscle), or too far medially (fig. 12) (internal pterygoid, buccinator, and superior constrictor muscles) *(2)*.

If the anesthetic solution is injected beyond the mandibular sulcus and into the parotid gland (fig. 13) there is danger of blocking branches of the facial nerve with a resultant temporary paralysis of the facial muscles on that side *(2)*.

Figure 9. Cross section of head at the level of the mandibular foramen showing anesthetic solution being deposited at mandibular foramen in close proximity to inferior alveolar nerve. Figure 10. Cross section of head at the level of the head of the condyle. 1. Head of condyle. 2. External pterygoid muscle. 3. Inferior alveolar nerve and vessels.

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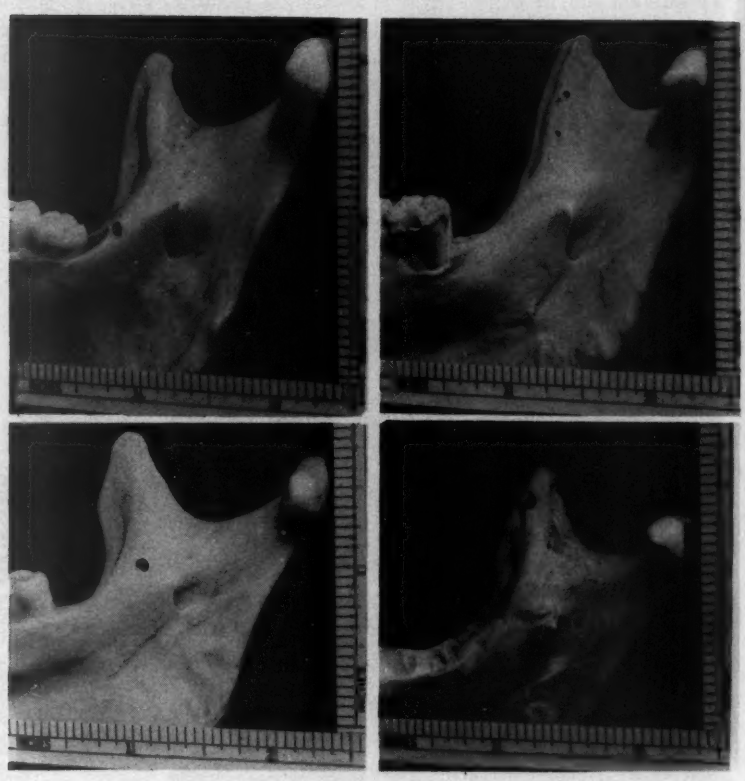

Figure 11. Medial surface of the ramus of four mandibles showing individual variations. Compare also with figures 3 and 8.

Figure 12. Cross section of head at the level of the mandibular foramen showing the anesthetic solution being deposited too far medially (in the substance of the internal pterygoid muscle). Figure 13. Cross section of head at the level of the mandibular foramen showing the anesthetic solution being deposited too far posteriorly (in the substance of the parotid gland).

If the needle is carried beyond the posterior border of the ramus, there is a possibility of entering the posterior facial vein (fig. 13) (4). This may be prevented by determining the width of the ramus, in the plane of the mandibular foramen, before the injection. If the anesthetic is deposited at the mandibular sulcus or foramen, it is possible to enter the inferior alveolar artery or vein because of their close approximation to the inferior alveolar nerve.

BOOK REVIEW

Textbook of Surgery, edited by *H. F. Moseley*, M. A., D. M., M. Ch. (Oxon), F. A. C. S., F. R. C. S. (Eng.), F. R. C. S. (C), Assistant Professor of Surgery, McGill University; Associate Surgeon, Royal Victoria Hospital, Montreal, Canada, with foreword by *G. Gavin Miller*, M. D., C. M., M. Sc., F. R. C. S. (C), F. A. C. S., Chairman of the Surgical Department, McGill University; Surgeon-in-Chief, Royal Victoria Hospital, Montreal, Canada. 896 pages; 460 text illustrations and 46 color plates. C. V. Mosby Co., St. Louis, Mo., publishers, 1952. Price $15.

This book is the joint effort of 28 contributors, all connected with the Royal Victoria Hospital and McGill University. It is interestingly written and the subject matter is all inclusive. The first chapter is on the evolution of modern surgery, a fascinating subject with which every medical student should be familiar. The fields covered include chemotherapy; preoperative considerations; anesthesia; plastic surgery; neurosurgery; diseases of the face, mouth, and neck; vascular surgery; thoracic surgery; urology; orthopedics; and those subjects normally considered as general surgery. Subjects are in general discussed under the subheadings historical considerations, anatomy, physiology, embryology, pathology, clinical findings, and treatment. Dr. Miller states in the foreword: "The undergraduate must be taught the principles of surgery, the appreciation of clinical signs and symptoms, and methods of examination, so as to arrive at an accurate diagnosis. This text emphasizes two aspects of teaching, namely, visual aid, and brevity of description." Each section is followed by an adequate bibliography. The volume is well illustrated with photographs and excellent color plates by Netter. It is particularly recommended for students, interns, and residents.

—*Col. W. A. Todd, Jr., MC, USA*

PULHES

The Physical Profile Serial System

EUGENE C. JACOBS, *Colonel, MC, U. S. A. (1)*

IN 1943 the Royal Canadian Army, in order to economize in the use of its manpower, adopted a method of physical classification which had been previously used in industry. It was called the PULHEMS classification. This system permitted each soldier to be used to his maximum capacity in a military assignment which would take his physical limitations into account. In a sense the PULHEMS classification was a form of "job specification" which could be interpreted and used for assignment purposes by nonmedical personnel, but before it could be fully utilized, it was necessary to analyze and to establish a minimum profile for each job in the Army. Furthermore the role of the unit, whether it be combat, support, or base operations had to be considered. This system of classification proved to be highly satisfactory to the Canadians. In 1945 it was adopted by the United States Army for its enlisted men and was called the PULHES Physical Profile Serial System. In 1952 it was further applied to the officer personnel.

THE NEED FOR A PHYSICAL PROFILE SYSTEM

Today the great weakness of the United States is its lack of manpower *(2)*. We have only 6 percent of the world's population as compared with 32 percent for our potential enemies *(3)*. If this country would attempt to counterbalance such tremendous manpower shortages, it is essential that every effort be made fully to develop and effectively to use our existing manpower resources *(4)*. We cannot afford to underutilize the skills and training of our men and women. No problem that we face is more important than proper utilization. We cannot afford round pegs in square holes *(5)*. Presently, the best

(1) Physical Standards Division, Office of Surgeon General, U. S. Army, at time of writing.

(2) Twenty-Sixth Report, Preparedness Subcommittee, U. S. Senate Committee on Armed Forces, 11 June 1951.

(3) Mutual security program; Armed Forces talk, No. 406, p. 10, May 9, 1952. U. S. Government Printing Office, Washington, D. C.

(4) Rusk, H. A.; Garrett, J. F.; Viscardi, H., Jr.; and Taylor, E. J.: Employability of chronically ill and disabled. (Commission on Chronic Illness.) J. A. M. A. 149: 595-597, June 7, 1952.

(5) Rosenberg, A. M.: Selection of Military Manpower—A Symposium. National Academy of Science - National Research Council, 1951. pp. 41-42.

substitute for manpower is a high degree of military proficiency. To obtain this there must be a well co-ordinated and balanced rationing of human resources, based both on a person's technical skill and his physical capacity to perform certain functions. The physical profile serial system provides a mechanism for classifying a person according to his physical fitness and his functional ability.

THE PHYSICAL PROFILE SERIAL SYSTEM

In this system the human functions are considered under 6 factors *(6, 7)*, each factor being designated by a letter, the significance of which is as follows:

P—Physique, or general physical capacity.
U—Upper extremity.
L—Lower extremity.
H—Hearing and ears (defects or disease).
E—Eyes (defects or disease) and vision.
S—Neuropsychiatry.

Each of these factors is considered and given a separate grade, ranging from 1 to 4, according to a person's functional ability in that factor. Number 1 represents higher than average efficiency with minimal or no physical defects; 2 indicates average efficiency with a mild physical defect; 3 represents below-average efficiency with a moderate physical defect which must not prevent the performance of some military duty in a satisfactory manner and must not be progressive in nature (grades 1, 2, and 3 are acceptable for military service); and 4 indicates poor efficiency due to a marked physical defect which renders a person unacceptable for military service except during a national emergency when specifically authorized by special directive.

When the physical profile serial has been completed, there is a sequence of six numbers, e. g., 213111. To facilitate assignment the various combinations of numbers in the physical profile serial are grouped into the following categories:

A—A profile in which lowest number is 1(e. g., 111111).
B—A profile in which lowest number is 2 (e. g., 112111).
C—A profile in which lowest number is 3 (e. g., 211113).
E—A profile in which lowest number is 4 (e. g., 412112).

A person with an A or B category is considered as acceptable for general military service. A person with a C category is also acceptable for military service, but, because of his physical defect, some consideration may have to be given to his assign-

(6) Section II, AR 40-115, 20 Aug. 1948, including Changes Nos. 1 and 2.
(7) Section II, AR 40-105, 9 Jan. 1952, including Changes Nos. 1 and 2.

ment. A person with a C category may be sent overseas, but it is not intended that he should be used in combat. A person with an E category is not generally acceptable for military service, but when a man is accepted into the service in an A, B, or C category and later on, through disease or injury, becomes classified in an E category, he does not of necessity have to be separated from the service. He may be retained or even re-enlisted provided that he is of value to the service and that there is no danger of his physical defect being aggravated by further military service *(8)*. When such a person is of doubtful value to the service, he would normally appear before a medical board so that his usefulness could be determined. When the physical category B, C, or E are recorded, a brief description of the physical defect in nontechnical language must accompany the physical profile serial report *(9)*.

In certain instances, additional information may be given in the physical profile serial by attaching a code letter as a suffix:

R—Indicates a defect which is remediable by corrective treatment and does not prevent a person's use in the military service.

T—Indicates a defect which is temporary in nature, and which, though it might be disqualifying if it persisted, could be so corrected by treatment that the person would become physically qualified.

D—Indicates a defect, which under current directives *(10)* is permanently disqualifying for overseas service. The suffix D can be removed only by a medical board. The basic policy for overseas service is contained in paragraph 11, SR 55-760-1 which states: "Any individual considered physically qualified for duty in the zone of interior, * * * is also considered qualified for overseas service * * *."

Profile serials having the suffix R or T, unless automatically released by a time factor specifically stated on the profile certificate, must be reviewed every 3 months until the defect no longer exists, at which time the suffix is removed by a designated profiling officer or board. The physical profile serial system is generally recognized as an important step in the process of achieving the utmost in the utilization of manpower. Great care is necessary in its accomplishment. The procedure is described in detail in Section II, AR 40-115 for enlisted personnel and in Section II, AR 40-105 for officers.

(8) Paragraph 8, AR 40-115.
(9) Paragraph 9, AR 40-115.
(10) Paragraph 16c(1), SR 600-175-20.

THE INITIAL PROFILE SERIAL

At the completion of the physical examination of each enlistee and inductee at an Armed Forces examining station or a main recruiting station, a designated medical officer accomplishes an initial profile serial and enters it along with the physical category in space 76 on the Standard Form 88, and also on the DD Form 47 (Record of Induction) or the DD Form 4 (Enlistment Record, United States), whichever is applicable *(11, 12)*.

VERIFICATION AND/OR REVISION OF THE PROFILE SERIAL

By a designated medical profiling officer. At the (1) induction station *(13, 14)*, (2) reception center *(15)*, (3) oversea command in the case of oversea returnees, (4) hospital or other medical installation in the case of patients, prior to return to duty *(16)*, (5) oversea replacement depot prior to overseas assignment, or (6) any unit when warranted in the case of permanent personnel assigned to the unit for duty each person concerned is interviewed and, if necessary, examined by a designated medical profiling officer to ascertain whether or not the recorded physical profile serial is a true reflection of his actual physical condition. If a man's unit commander or a classification and assignment officer are available, it is desirable that they assist the profiling officer in the verification and revision of the physical profile serial. On completion of the physical profile serial, the profiling officer submits a letter report *(17)* to the man's unit commander, so that he may effect the necessary assignment of the soldier within the unit, and may make an appropriate entry on his records. If any change in the soldier's military occupational specialty (MOS) number or assignment to a different unit is anticipated by the profiling officer, the profile certificate must be routed through the classification and assignment office for necessary action prior to being mailed to the unit commander.

By a profile classification board. The profile classification board consists of a medical officer (preferably one experienced in profiling) assisted by a line officer (the soldier's unit commander or his training officer) and a classification and assignment officer. At the (1) training division or replacement training center at or near the seventh week of basic training *(18)*, (2)

(11) Paragraph 12h(6), SR 615-100-1.
(12) Paragraph 14d(1), SR 615-180-1.
(13) Paragraph 13, SR 615-100-1.
(14) Paragraph 21b(1), SR 615-180-1.
(15) SR 600-510-5.
(16) SR 600-145-11.
(17) Paragraphs 9 and 10, AR 40-115.
(18) Paragraph 10c(1), Change 2, AR 40-115.

home station of soldiers in preparation for oversea replacement, except those in training division or replacement training center *(19)*, (3) reception stations (only when oversea returnee is to be assigned to permanent duty), or (4) hospital in the case of the retention and utilization of partially disabled personnel *(20)* each person concerned is interviewed and, if necessary, examined by the profile classification board to ascertain whether or not the recorded physical profile serial is a true reflection of his actual physical condition. Recent physical fitness tests *(21)* are considered in determining the appropriate physical profile serial. On completion of the physical profile serial, the profile classification board submits a letter report *(17)* to the soldier's unit commander so that he may effect necessary assignment of the soldier within the unit and may make appropriate entries on his records. If any change in the soldier's MOS number or assignment to a different unit is anticipated by the profiling board, the profile certificate must be routed through the classification and assignment office for necessary action prior to being mailed to the unit commander.

PULHES PROBLEMS

Recent inspections of class I and class II hospitals reveal that some commanding officers have not designated medical profiling officers as is required by paragraph 9b(1) AR 40-105 and paragraph 9b(1) AR 40-115 which states: "The commanding officer of the hospital will designate one or more officers who will be responsible for all profiling at that installation." In these hospitals, the physical profile serials are being accomplished by each ward officer and noted on the clinical record when the patient is returned to duty. Some of these ward officers have had very little experience in the application of the physical profile serial. As a result, the profiles are being accomplished in a great variety of ways. Many errors and omissions are occurring in the profiles of patients returning to duty. The brief nontechnical description of the physical defect is frequently omitted; suffixes R, T, and D are occasionally misused; and, in a few cases, the profiles and/or profile certificates are not accomplished.

As a consequence of such profiling, the classification and assignment officer has difficulty in assigning appropriate MOS numbers. In some cases the profile certificates are completely bypassing both the profiling officer and the classification and assignment officer when the recorded profile would appear to

(19) Paragraph 16, SR 600-175-20.
(20) SR 600-145-15.
(21) Chapter 17, FM 21-20.

warrant a change in the MOS number. This occurs because the ward officer mails the certificate directly to the unit commander.

It was the intent of AR 40-105 and AR 40-115 that all profiling for each Army hospital and other medical installation be accomplished by one or more designated profiling officers at a central office in the presence of and with the aid of a classification and assignment officer. Paragraph 6h, AR 40-105 states that "The profile will be utilized by the responsible classification officer as an administrative procedure in assessing the individual's ability to fill certain duty assignments. A close relationship must therefore exist between the medical (profiling) officer and the classification officer * * *."

In some cases it appears that the classification officers have not been adequately trained to interpret physical profile serials and to assign appropriate MOS numbers. It is intended to send such officers to the Adjutant General's School in the near future.

Some unit commanders have not been giving proper attention to the physical profile serials and to the MOS numbers; as a result, many complaints have been made by soldiers to parents and congressmen. A request has been made to the Army Field Forces to have all unit commanders instructed in the use of profile serials and the MOS numbers.

It appears that some unit commanders and classification officers, when senior to the medical officer on the profile classification board, have tried to dictate the "findings" to the board.

Paragraph 10c, Change No. 2 of AR 40-115 states that the medical officer will be assisted by the line officer and the classification officer.

USE OF THE PROFILE SERIAL SYSTEM

To function successfully a system of this type must have no weak links; it must be correctly applied by the medical officer so as to represent truly the soldier's ability to perform military service; it must be strictly translated by the classification officer into the proper MOS number in order to assign the soldier to the appropriate unit; and it must be carefully considered along with the MOS number in assigning the soldier to military duties within the unit. This analysis and use of a person's physical and mental status as recorded in the profile serial will play an important role in the soldier's future military assignment as well as his performance of duty. Every effort must be made to impress those concerned with the profile system of its importance and to instruct them in its correct use.

SUMMARY

In 1943 the Royal Canadian Army adopted the PULHEMS Classification from industry in order to economize in the use of its manpower. It permitted each soldier to be used to his maximum capacity in a military duty with which his particular limitations would not interfere. With slight modification the United States Army adopted the Physical Profile Serial System for enlisted men in 1945 and for officers in 1952. It was called the PULHES system and is rapidly becoming an important step in the placing of the right man in the right job—a job that he is physically qualified to perform. This system is permitting the Army to reach a high degree of military proficiency, which will greatly assist in the counterbalancing of manpower shortages—America's great weakness today.

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EFFECTIVENESS OF DDT IN THE CONTROL OF BODY LICE IN GERMANY[1]

RALPH W. BUNN, *Lieutenant Colonel, MSC, USA* (2)

RECENT reports of the failure of DDT to control the body louse effectively in Korea (3, 4) raised the question as to whether similar resistance to DDT existed in lice in Germany. DDT powder has been used extensively in Germany in the past for control of lice and typhus fever with excellent results. For example, the 820th Quartermaster Sterilization Company alone, in 1944 and 1945, dusted about 2 million persons, using over 37 tons of DDT in the process. The question of whether or not the lice in Germany had developed resistance to DDT was important because thousands of pounds of 10-percent DDT powder are maintained in quartermaster depots for emergency use in the event of a typhus epidemic. If this material could not be relied on for louse control, immediate steps would be necessary to find an effective substitute.

EXPERIMENTAL PROCEDURE

Persons infested with body lice are rare in Germany today. Field tests were therefore not practicable and it was necessary to rely entirely on laboratory tests. Five strains of lice were collected from mid-January to mid-February, 1952. Four of these came from vagrants in the Frankfurt city jail. The fifth strain was obtained in Berlin from a refugee from the East Zone of Germany through the co-operation of the German Red Cross. In only one instance were sufficient lice obtained to conduct a test on the parent stock. In all other cases, additional lice had to be reared in the laboratory before tests could be made. Rearing was accomplished by keeping the lice on a circular swatch of wool Army uniform cloth 1.5 inches in diameter in a 50-ml. beaker

(1) From the 4th Medical Field Laboratory, Army, European Command.

(2) Now in the Preventive Medicine Division, Office of the Surgeon General, Department of the Army.

(3) Eddy, G. W.: Report on effectiveness of certain insecticides against DDT-resistant body lice in Korea. Interim Report No. 0-141, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Nov. 1951.

(4) Barnett, H. C., and Knoblock, E. C.: Chemical and biological studies on DDT resistance of lice. U. S. Armed Forces M. J. 3: 297-304, Feb. 1952.

placed in an incubator maintaining a temperature of about 85° F. and a relative humidity of 60 percent. The lice were fed twice daily on human blood. The containers used for rearing and feeding are shown in figure 1.

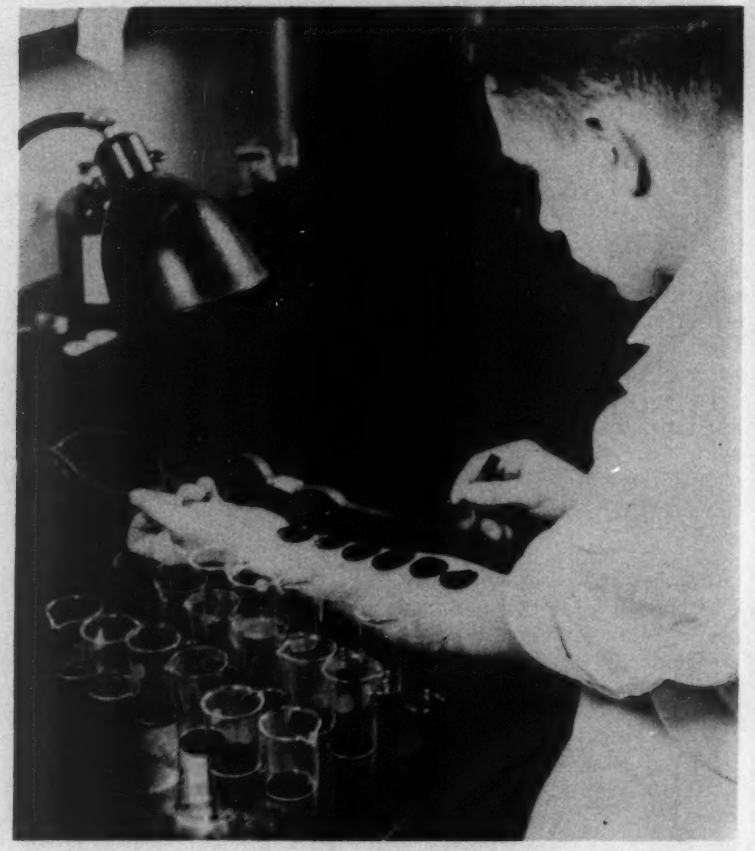

Figure 1. Laboratory technician feeding body lice.

Tests were conducted by treating a circular swatch of wool uniform cloth 1.5 inches in diameter with the desired quantity of standard 10-percent DDT powder (QM item 51-I-180), rubbing the material evenly onto both sides of the swatch. The swatch was placed in the bottom of a 50-ml. beaker and 20 adult or third-instar nymphs were introduced. The beakers were kept in an incubator at 85° F. and 60 percent relative humidity. The lice were given an opportunity to feed twice daily, and mortality records were obtained 24 and 48 hours after the initial exposure

to the treated swatch. Lice classified as living showed no noticeable effect of the DDT and those affected but still capable of movement were classified as moribund. In nearly all tests an equal number of male and female lice were used. All controls showed negligible mortality. Some initial tests were also made using the same type of powder packaged in a 2-oz. rather than the 5-lb. can. The results with the 2 powders were similar. Chemical analysis of these samples showed that the DDT content of both fulfilled the specifications.

TABLE 1. *Mortality of body lice in constant contact with DDT-treated cloth, using 20 lice per test and 5 tests with each strain and rate of treatment*

Louse strain	Number of lice used	After 24 hours (percent)			After 48 hours (percent)		
		Living	Moribund	Dead	Living	Moribund	Dead
Cloth treated with 27 mg. of 10-percent DDT powder per sq. in.							
A	100	3	16	81	0	0	100
B	100	0	2	98	0	0	100
C	100	0	3	97	0	0	100
D	100	0	1	99	0	0	100
Cloth treated with 13 mg. of 10-percent DDT powder per sq. in.							
A	100	5	4	91	0	0	100
B	100	5	4	91	1	0	99
C	100	2	2	96	0	0	100
D	100	2	2	96	0	0	100
E	100	4	16	80	0	0	100

MORTALITY TESTS

Initial tests were made as described above by applying DDT powder to the cloth swatches at a rate of 27 mg. of the 10-percent DDT powder per square inch of cloth and leaving the lice in contact with the cloth for the duration of the test. This application rate is equivalent to more than 3 oz. of powder for a complete uniform and is in excess of the application rates generally used. Because all the lice were killed in the tests, the application rate was reduced to 13 mg. per square inch in subsequent experiments, the equivalent of about 1.5 oz. per uniform. The results of the tests are shown in table 1. The mortality of lice after 24 hours ranged from 81 to 99 percent with the heavy dosage and from 80 to 96 percent with the light dosage. Out of 900 lice used in these tests only one louse that had been on a lightly treated swatch remained alive after 48 hours.

A second series of experiments was designed to determine the length of time of contact with treated cloth required to kill all lice. The lighter rate of application was used. Lice were placed on a treated swatch as before, but were then removed from the treated swatch after the desired time interval and held on an untreated cloth for the 24- and 48-hour observations. The results are shown in table 2. These results show that lice must remain in contact with the treated cloth for nearly a full day before 100 percent mortality can be expected.

TABLE 2. *Mortality of body lice after various periods of contact with DDT-treated cloth using 20 lice in each test and 13 mg. of 10-percent DDT powder per sq. in. of cloth*

Louse strain	Length of exposure (hours)	After 24 hours (Percent)			After 48 hours (Percent)		
		Living	Moribund	Dead	Living	Moribund	Dead
B	6.5	80	10	10	80	0	20
B	9.5	40	15	45	40	0	60
B	16.0	10	0	90	5	0	95
A	17.0	25	5	70	20	0	80
A	18.0	35	5	60	30	0	70
B	20.0	0	0	100	0	0	100
B	20.0	0	0	100	0	0	100
C	20.0	10	15	75	5	0	95
D	22.0	0	5	95	0	0	100
B	22.5	5	0	95	5	0	95
A	23.0	0	0	100	0	0	100
B	23.0	0	5	95	0	0	100
C	23.0	0	10	90	0	0	100
D	23.0	0	0	100	0	0	100
E	23.0	0	0	100	0	0	100

A limited number of tests were made to determine the effectiveness of swatches at varying intervals after they had been treated. Treated swatches were hung on open racks in the laboratory, then tested after varying intervals as shown in table 3. Complete mortality at 48 hours was obtained in all tests except one with a 28-day old swatch. In this test, two lice were still capable of movement at the end of the 48-hour period.

TABLE 3. *Mortality of body lice in constant contact with cloth treated with DDT at various periods prior to test, using 20 lice per test and cloth treated with 13 mg. of 10-percent DDT powder per sq. in.*

Louse strain	Age of swatch at time of test (days)	After 24 hours (Percent)			After 48 hours (Percent)		
		Living	Moribund	Dead	Living	Moribund	Dead
D	14	15	10	75	0	0	100
B	21	35	25	40	0	0	100
D	21	10	5	85	0	0	100
A	28	55	25	20	0	10	90
E	28	10	15	75	0	0	100

DISCUSSION

These tests indicate that the standard Army louse powder containing 10-percent DDT, applied at a rate of about 1.5 oz. per uniform, will achieve satisfactory control of the body lice collected in Germany when the lice are in continuous contact with the treated cloth. Lice must be in contact with the treated cloth for about 24 hours before a complete kill can be expected.

Eddy *(3)* reported that in tests with normal laboratory lice at Orlando, Fla., powder containing only 0.1 percent usually caused 100 percent kills in 24 hours. Although no comparable tests have been made to date with the German strains, it may be noted that 100-percent mortality was not obtained in these tests in 24 hours using the 10-percent powder. There is some indication, therefore, that the German strains are somewhat more resistant to DDT than is the normal Orlando laboratory strain.

SUMMARY

Laboratory tests on 5 strains of body lice collected in Germany indicate that the standard Army 10-percent DDT powder will achieve effective louse control. There is evidence, however, that the louse strains tested are somewhat less susceptible to DDT than is the Orlando laboratory strain.

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BOOK REVIEWS

Nerve Impulse, Transactions of the Third Conference, 3 and 4 March 1952, New York, N. Y., edited by *H. Houston Merritt*, M. D., Professor of Neurology, College of Physicians and Surgeons, Columbia University, New York, N. Y. Sponsored by the Josiah Macy, Jr. Foundation. 176 pages; illustrated. Printed by Progress Associates, Inc., Caldwell, N. J., 1952. Price $3.50.

The introduction to this book is by Doctor Fremont-Smith Medical Director of the Josiah Macy, Jr. Foundation, who outlines the purpose of multiprofessional conferences such as the one here reported, stating that in bringing together scientists from many fields of research, it is hoped to promote "meaningful communication between scientific disciplines." "Biochemical Similarities and Differences Between Synaptic Transmission and Axonal Conduction," "Electrical Similarities and Differences Between Synaptic Transmission and Axonal Conduction," and "The Structure of Synaptic Junctions" form the 3 chapters of the book, each chapter being a verbatim report of an informal round-table discussion. This is a scientific and erudite work. The practicing physician must be well-versed in the semantics of advanced chemistry, biophysics, and the like fully to comprehend these discussions.—*Lt. Col. J. W. Sumner, MC, USA*

United States Army in World War II, Pictorial Record, The War Against Japan. *Office of the Chief of Military History, Department of the Army*, Washington, D. C., 1952. 471 pages; illustrated. Printed by U. S. Government Printing Office, Washington, D. C., 1952.

This volume is divided into the following sections: (1) The Allied Defensive; (2) The Strategic Defensive and Tactical Offensive; (3) The Offensive—1944; (4) The Final Phase; (5) The China-Burma-India Theatre; and (6) The Collapse of Japan, and the End of the War in the Pacific. Because it is a supplement to corresponding narrative volumes, the text is brief, consisting of a short introduction in each section outlining the major events which are depicted in detail by the well-captioned photographs. The pictures show the types of terrain, equipment, and weapons of friendly and enemy forces. Episodes of human interest and the living conditions under which these operations were conducted are well illustrated. The types of military operations, with stress on amphibious warfare which prevailed in the Pacific, are emphasized. Used in conjunction with the corresponding narrative volumes, this book is invaluable.

—*Brig. Gen. C. F. Sams, MC, USA*

FATAL ANAPHYLACTIC REACTION FOLLOWING PENICILLIN INJECTION[1]

WILLIAM N. CHRISTENSON, *Lieutenant, MC, USNR*
GERALD W. HEDRICK, *Lieutenant, junior grade, MC, USNR*
ROBERT F. SCHUGMANN, *Commander, MC, USN*

ANAPHYLACTIC reactions following the use of penicillin are the most dramatic of the several varieties of penicillin reactions that have been described, and their seriousness is demonstrated by the fact that of the 8 previously reported instances 3 have been fatal. This report will describe a fourth such fatality which occurred in a patient without previous history of allergy and who had been given penicillin previously without reaction.

O'Donovan and Klorfajn (2) produced an anaphylactoid state in a patient known to be penicillin-sensitive by giving an intramuscular injection of 15,000 units of penicillin; this reaction was not fatal. Wilensky (3) reported the first death from anaphylaxis following treatment with penicillin. Waldbott (4) reported another. Cormia et al. (5) reported an anaphylactoid reaction following 20,000 units of penicillin. Burleson (6) described a case of anaphylactoid shock following the injection of 200,000 units of crystalline sodium penicillin G and 0.5 cc. of 1 percent procaine. The patient responded to immediate treatment with diphenhydramine given intravenously. Everett (7) reported two nonfatal anaphylactic reactions which followed the intrasinus instillation of penicillin. Thomson (8) described another fatal

(1) From U. S. N. S. *General Alexander M. Patch.*

(2) O'Donovan, W. J., and Klorfajn, I.: Sensitivity to penicillin; anaphylaxis and desensitisation. Lancet 2: 444-446, Sept. 28, 1946.

(3) Wilensky, A. O.: Fatal delayed anaphylactic shock after penicillin (Comment on Gordon's article in letter to the Editor). J. A. M. A. 131: 1384, Aug. 17, 1946.

(4) Waldbott, G. L.: Anaphylactic death from penicillin. J. A. M. A. 139: 526-527, Feb. 19, 1949.

(5) Cormia, F. E.; Jacobsen, L. Y.; and Smith, E. L.: Reactions to penicillin. Bull. U. S. Army M. Dept. 4: 694-702, Dec. 1945.

(6) Burleson, R. J.: Anaphylactoid shock due to penicillin; report of case. J. A. M. A. 142: 562-563, Feb. 25, 1950.

(7) Everett, R.: Anaphylactic reactions from local use of penicillin; report of 2 cases. J. A. M. A. 146: 1314-1315, Aug. 4, 1951.

(8) Thomson, W. O.: Sudden death following injection of penicillin. Brit. M. J. 2: 70-72, July 12, 1952.

anaphylactic reaction which followed the intramuscular injection of 300,000 units of crystalline penicillin G in a patient with a long history of penicillin therapy. Two months previously this patient had sustained an anaphylactoid reaction after receiving procaine penicillin. Because the previous reaction was attributed to the procaine portion of this mixture, he was given crystalline penicillin in the latter instance. An autopsy disclosed several small petechial hemorrhages in the heart and lungs in addition to a number of chronic disease processes.

A fourth fatal reaction recently occurred aboard the U. S. N. S. *General Alexander M. Patch* during a transatlantic voyage.

CASE REPORT

A 48-year-old Negro reported to the ship's hospital on 30 May 1952, complaining of a urethral discharge of 2 days' duration. Three smears were made on subsequent days, each showing only a mixture of gram-positive organisms, and a diagnosis of nonspecific urethritis was made. After the last smear, the patient was told to return on the following day for penicillin therapy. At 1300 on 2 June he was given an intramuscular injection of 300,000 units of procaine penicillin G.

Within 5 minutes he began to complain of generalized pruritus. He became nauseated, vomited, and collapsed on the deck. A generalized tonic seizure followed, accompanied by urinary and fecal incontinence, after which he was unconscious and pulseless. When seen by a medical officer about 5 minutes after the onset of the reaction he was unconscious and apneic; his eyes were rolled upward; his skin showed generalized rubor; his reflexes were absent; and his pulse and blood pressure were unobtainable. An intravenous injection of 0.2 cc. of 1:1,000 aqueous solution of epinephrine was given immediately, followed by an intramuscular injection of 0.8 cc. of this solution. Irregular, shallow respirations returned, but, because the pulse and blood pressure remained unobtainable, 0.5 cc. of the solution was injected into his heart. Shortly after this a weak pulse of 120 beats per minute became palpable, and the blood pressure rose to 60/40, but the patient remained comatose. Further examination revealed diffuse musical wheezes and moist rales throughout all lung fields, small but equal pupils which did not react to light, generalized flaccidity without obtainable deep tendon reflexes, and lack of any response to painful or other stimuli. At no time were heart sounds audible.

Treatment consisted of intramuscular injections of epinephrine, ephedrine, and coramine and intravenous injections of calcium gluconate and aminophylline at varying intervals, all without evident effect. Oxygen was supplied constantly by mask. There

was no change in the state of consciousness and there were no further convulsions. The patient vomited from time to time, requiring frequent aspiration of the airway. His blood pressure did not rise above 60/40 and his respirations remained shallow at a rate of 20 to 30 per minute. He did not react to any stimuli, though he had a further episode of fecal incontinence 2 hours after the onset of the reaction. The terminal portion of this discharge showed gross blood and the vomitus later presented the appearance of "engine oil."

The patient continued in this state for 5 hours. To exclude the possibility of a cerebral hemorrhage, a lumbar puncture was performed. This revealed an initial pressure of 200 mm. cerebrospinal fluid, which was crystal clear and showed no cells on microscopic examination. Fifteen minutes later the patient's respirations ceased and his pulse disappeared. Repeated intracardiac injections of epinephrine were without effect and he was pronounced dead 5½ hours after the onset of the reaction.

An examination of the patient's previous medical records showed that in February he had been treated with penicillin ophthalmic ointment for conjunctivitis and that 1½ years previously he had received 3 injections of procaine penicillin in peanut oil. There was no record of any untoward reaction to these medications. No history of allergy could be obtained and a routine physical examination on 15 April had not demonstrated any abnormality.

Autopsy report. The heart, weighing 380 grams, appeared small for the size of the patient's body (estimated weight 210 pounds). Microscopic study revealed moderate congestive edema and acute myocardial degeneration. There was marked congestive hyperemia, mild edema, and partial atelectasis of both lungs. The splenic pulp revealed focal areas of hyperemia with hemorrhage. Edema of the pulp was prominent. The appearance was that of mild toxic splenitis. There was mild congestive edema and mild centrolobular toxic degeneration of the liver cells. There was acute congestive hyperemia of the intestine with hemorrhage into the small and large bowel. The kidneys presented acute interstitial edema. Some proximal tubules revealed degeneration of the epithelium. Focal arrangements of sclerotic glomeruli were seen. There was an acute right epididymitis. There were some foci of edema and degeneration of the cortical cells of the adrenals. There appeared to be acute congestive edema of the brain. No evidence of cerebral hemorrhage was found.

DISCUSSION

This is the fourth report of a sudden death occurring immediately after the injection of penicillin into a person who had

been previously treated with this antibiotic. In each instance the clinical aspects of the reaction corresponded with the description of acute anaphylaxis, and in the present case this impression was borne out by the postmortem study, which revealed evidence of generalized smooth muscle spasm, extreme splanchnic congestion with hemorrhage, and areas of acute toxic degeneration in the internal organs. Each fatal case, as well as those that did not die, had a history of previous treatment with penicillin. One of the fatal cases had bronchial asthma *(4)*, but in Thomson's *(8)* and in the present case there was no history of asthma or other form of allergy. It is apparent that either procaine penicillin or crystalline penicillin alone can elicit a fatal reaction. In the present case it is interesting to note that each of the types of penicillin vehicle previously used, i. e., in oil and as a topical ointment, is considered to be a potent sensitizing agent for the development of hypersensitivity.

With the extreme popularity of penicillin therapy the number of patients who will give a history of previous treatment with penicillin is constantly increasing. Therefore, an increase in the number of anaphylactic reactions to this drug may be expected and indeed many physicians may have encountered instances of milder anaphylactoid reactions similar to the second one described in Everett's report *(7)*. Careful history taking can prevent such an occurrence, and this point is especially important because the second reaction may be fatal, as in Thomson's patient *(8)*. A negative allergic history does not insure against the occurrence of such a reaction, but in the presence of an allergic history the drug must be given with great caution.

The experience of Burleson *(6)* indicates that the immediate intravenous injection of diphenhydramine may be of great value, and, if given rapidly enough, it might be lifesaving. In the present case this drug was not available, and epinephrine, though of some benefit, failed to control the reaction adequately.

WATER CHLORINATION

STANLEY J. WEIDENKOPF, *Lieutenant Colonel, MSC, USA (1)*

CHLORINE was first used as a routine disinfectant for public water supplies in 1908 when bleaching powder or hypochlorite was used to treat the water supply for Jersey City, N. J. The success of this project, plus the fact that the country was still in an era of major typhoid epidemics, resulted in a rapid acceptance of this method of water purification. Epidemiologically, expectations were realized, and the transmission of typhoid and other enteric diseases through drinking water was sharply reduced. The bacteriologist could verify the effectiveness of chlorination by counting bacteria before and after small amounts of chlorine were added to contaminated water and noting the reduction effected.

The Army early recognized the value of chlorine as a water disinfecting agent and sponsored research and development in this field. The first application of liquid chlorine to a water supply in this country was at Fort Myer, Va., by Major (later Brigadier General) C. R. Darnall, MC, USA. Although the advances in water-treatment methods and equipment at military posts paralleled those in civilian communities, the Army in the field had problems without civilian counterpart and proceeded to search for solutions to these important problems. By 1915, Major William J. Lyster, MC, *(2)* had designed a water-sterilizing bag and developed a method for disinfecting its content by using chlorine in the form of calcium hypochlorite.

The A. E. F. in World War I established a policy that all water for troop consumption was to be considered of doubtful quality and to be purified unless found to be acceptable by a series of examinations and tests *(3)*. To accomplish this purification, calcium hypochlorite was used in water-sterilizing bags, chlorinating tanks, tank carts, tank trucks, and tank trains. Javelle water, a chlorine solution obtained from the French, was also used for these purposes. Liquid chlorine was used by the rear-area semipermanent, water-treatment plants and by the 2 types

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(1) Preventive Medicine Division, Office of the Surgeon General, Department of the Army.

(2) Lyster, W. J.: Sterilization of drinking water by calcium hypochlorite in the field. Mil. Surgeon 36: 222, 1915.

(3) Ireland, M. W., and Weed, F. W.: The Medical Department of the United Army in the World War; Volume VI, Sanitation. Government Printing Office, Washington, D. C., 1926. pp. 772-820.

of mobile purification trucks (sterilabs and chloro-pumps) used by the field Armies. The A. E. F. also recognized that it was no longer practical for the individual soldier to procure his own drinking water and that it must be supplied to him on an organizational basis by specialized water-treatment units. This made it possible, for the first time, to exercise quality control over water consumed by troops.

Since World War I, water purification has advanced to a recognized scientific specialty. There have been 3 definite periods in the development of the science of water chlorination:

1. The first period followed introduction of the chlorine in 1908. During this period it was generally thought that some constant, fixed amount of chlorine could be used to sterilize any and all water. Research at that time was directed toward determining what that *universal dosage* should be.

2. The second period was one in which it was recognized that waters varied in composition and required varying amounts of chlorine. It was then thought that it was the chlorine residual, rather than the dose, that was important and all research was directed toward finding some *universal residual* that would guarantee a safe drinking water.

3. The present period is one in which it is still recognized that a residual is necessary but that, in addition, it is also necessary to know the *form of the chlorine in the residual* before it is possible to predict the efficiency of the purification process.

THEORY OF CHLORINATION

The present concept of the chlorination of natural waters is that chlorine remains in the water as molecular chlorine for only a very short time and then combines with (1) inorganic reducing substances, (2) ammonia and amines, (3) organic substances other than amines, and (4) water to form various compounds.

An understanding of the mechanism of these reactions is essential to predicting the success of chlorination.

The combination of chlorine with inorganic reducing substances. The most frequently encountered reducing substances are ferrous iron, manganous manganese, nitrites, and hydrogen sulfide. In accordance with the chemical laws these substances react with chlorine much more rapidly than organic substances. The chlorine going into these reactions loses its bactericidal action completely. Enough chlorine must be supplied to complete these reactions before disinfection can be accomplished.

The combination of chlorine with ammonia and amines. Ammonia and amines are frequently present in natural waters and react

readily with hypochlorous acid to form monochloramine (NH_2Cl), dichloramine ($NHCl_2$), or nitrogen trichloride (NCl_3) (4). This is probably a step reaction as represented by the following equations:

$$NH_3 + HOCl \longrightarrow NH_2Cl + H_2O$$

$$NH_2Cl + HOCl \longrightarrow NHCl_2 + H_2O$$

$$NHCl_2 + HOCl \longrightarrow NCl_3 + H_2O$$

The disinfecting action of chlorine is modified by its change to chloramine but in this form the chlorine continues to destroy bacteria. The principal factors affecting the effectiveness of the chloramines are (1) the pH of the solution, (2) the temperature of the solution, and (3) the concentration of chloramines (5).

The pH of the solution has an important influence on the bactericidal activity of the chloramine. With an increase in pH, there is a corresponding decrease in the bactericidal action of the solution. This is explained on the basis of the relative amounts of dichloramine and monochloramine in the solution, the dichloramine (formed at lower pH values) being the more effective disinfectant and therefore the more desirable of the two chloramines (4). Also, the presence of an excess of ammonia affects the formation of the desirable dichloramine. With a chlorine to ammonia weight ratio of 5:1, the following may be expected:

pH	*Percent of chlorine as dichloramine*
5	84
6	62
7	35
8	15
9	6

The temperature of the chloramine solution also affects the bactericidal action. A general rule was found to be that a reduction of 20° C. (from about 23° C. to about 3° C.) necessitated 9 times as long a period of contact or 2.5 times as much chloramine to produce a complete kill of bacteria.

(4) Fair, G. M.: New concept of water chlorination. Eng. News Rec. 141: 60, 1948.

(5) Butterfield, C. T., and Wattie, E.: Influence of pH and temperature on survival of coliforms and enteric pathogens when exposed to chloramine. Pub. Health Rep. 61: 157-192, Feb. 8, 1946.

Chloramines are much less efficient bactericidally than free chlorine. About 25 times as much chloramine as free chlorine is required under similar conditions, and 100 times as long a contact period is required for chloramine if the same amount of each is used. In a water of a high pH chloramines will produce very little bactericidal action at low temperatures.

The combination of chlorine with organic substances other than amines. All natural surface waters and some ground waters contain organic matter. Chlorine reacts with oxidizable organic material, as well as with the amines and inorganic substances mentioned. Many of the reaction products have objectionable odors. When sufficient chlorine is present, the reactions go through to completion and form stable compounds which do not contribute to tastes and odors. The amount of chlorine necessary to complete these reactions is in direct proportion to the amount of organic material present in the water, and an examination of the specific water under consideration is necessary to yield that information. A rough estimate of the amount of organic matter present in the water can usually be obtained by carefully noting the color of the water. Water with greater amounts of color will usually require more chlorine. Because the chlorine consumed by these reactions is completely lost insofar as its bactericidal action is concerned, sufficient chlorine must be added to water to stabilize the organic material and leave a residual to meet the other demands.

The combination of chlorine and water to form free available chlorine. Free available chlorine is the name commonly applied to a group of 3 forms of chlorine which may be found in water. These are molecular chlorine (Cl_2), hypochlorous acid (HOCl), and hypochlorite ion (OCl^-) (*4*). These compounds are formed initially if there are no nitrogenous compounds present in the water and there is sufficient chlorine to satisfy the organic and inorganic demands. If nitrogenous compounds are present, they can be removed by the addition of sufficient chlorine first to form and then decompose chloramines, after which free available chlorine compounds will be formed. *Of these 3 forms of free chlorine, only HOCl destroys bacteria.* The following equations show the development of the chlorine compounds in water:

$$Cl_2 + H_2O \rightleftharpoons HOCl + H^+ + Cl^-$$

$$HOCl \rightleftharpoons H + OCl^-$$

The relative amounts of these compounds which will be formed are a function of the pH of the solution, and are given in table 1 (*6*).

(*6*) Committee on Water Supply, American Public Health Association. Am. J. Pub. Health 38: 221, 1948.

The bactericidal efficiency of free available chlorine is determined by the pH of the solution, the contact time, and the temperature. The pH of the solution determines the relative amount of the chlorine which will be in the form of HOCl. The longer the contact time of the HOCl with the bacteria, the greater the resultant kill. In pH ranges between 7 and 8.5, the bactericidal properties of free chlorine are not affected by low temperatures (7). At higher pH values, the activity is retarded by lowering the temperature.

TABLE 1. *Percent of free available chlorine as:*

pH	Molecular chlorine	Hypochlorous acid	Hypochlorite ion
4	0.5	99.5	0
5	0	99.5	0.5
6	0	96.5	3.5
7	0	72.5	27.5
8	0	21.5	78.5
9	0	1.0	99.0
10	0	0.1	99.9

BREAK-POINT CHLORINATION

Break-point chlorination is the process which takes full advantage of the present knowledge about the mode and action of chlorine when it is introduced into natural waters. It requires the addition of a sufficient quantity of chlorine to meet all the demands of the water (stabilize certain organic and inorganic substances) and still leave a residual of free available chlorine. Break-point chlorination controls both the amount of the residual chlorine and, more important, the nature or form of that chlorine. The older processes controlled only the amount of the residual chlorine.

The advantages which can be expected from the break-point process and the resulting free available chlorine are: (1) a quick and reliable killing of bacteria; (2) reduction in tastes and odors resulting from organic materials present in the water; (3) bleaching of color in the water; (4) oxidation of certain organic and inorganic substances; and (5) prevention of biologic growths in the filter plant and distribution system.

The only disadvantage is a slightly higher chlorine consumption. Some water may require less than 1 p. p. m. to produce free re-

(7) Butterfield, C. T.: Bactericidal properties of free and combined available chlorine. J. Am. Water Works Assoc. 40: 1305, 1948.

sidual chlorine; other water may require from 15 to 20 p. p. m. In one case on record 110 p. p. m. was required.

Break-point chlorination is normally the method of choice for both garrison and field treatment. This process should always be used when it is necessary to have safe water quickly and when the water may become recontaminated. The chloramine process may be used when there is a long contact period before the water is used and when there is no possibility of recontamination. The two processes may be combined by employing break-point chlorination at the treatment plant and chloramines in the distribution system.

TESTING FOR RESIDUAL CHLORINE

The tests most commonly used in the field to measure chlorine in water are: (1) the standard orthotolidine test; (2) the orthotolidine flash test; and (3) the orthotolidine-arsenite test.

The standard orthotolidine test, made by adding orthotolidine to water and waiting 5 minutes, measures the total chlorine residual in the water, but it does not differentiate between free available chlorine and chloramines. Its accuracy may be affected by the presence of certain interfering oxidizing agents. The effect of these interfering substances is to develop additional color above that resulting from the chlorine.

The orthotolidine flash test may be used to obtain a qualitative determination of the presence of free available chlorine *(8)*. Free available chlorine reacts almost instantly with orthotolidine, but chloramines react relatively slowly. This difference is especially noticeable at temperatures below 60° F. It follows that the reading obtained about 5 seconds after the addition of orthotolidine will approximate the amount of free available chlorine in the water and the reading taken after 5 minutes will give the total available chlorine in the water. The difference between these readings will be the amount of combined available chlorine (chloramines) in the water.

The orthotolidine-arsenite test measures the relative amounts of free available chlorine and combined available chlorine; it also corrects false color reactions due to interfering substances in the water. It is the most accurate and dependable of the field tests and is the test of choice if free available chlorine is to be measured or if it is suspected that interfering substances are present. It is slightly more complicated than the standard orthotolidine test, involving two reagents (orthotolidine and sodium arsenite).

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(8) Laux, P. C.: Break-point chlorination at Anderson. J. Am. Water Works Assoc. 32: 1207, 1940.

A new Medical Service water-testing kit that can be used for performing all of these tests, as well as determining pH and residual chlorine levels from 0 to 250 p. p. m., has been standardized and should be in supply channels in 1953.

THE ACTION OF CHLORINE ON BACTERIA CELLS (9)

It is reasoned that because chlorine is effective at only trace levels, it must inhibit some key enzymatic process within the cell. This was determined to be the oxidation of glucose by the cell. Once this power is lost, the cell dies. Chlorine probably stops the action of triosephosphoric dehydrogenase, an enzyme that catalyzes an oxidation reaction essential to the utilization of glucose. The fact that iodine seems to act on some other essential enzyme may explain its greater cysticidal power. When enzymes are removed from cells, they are equally susceptible to destruction by a number of other oxidizing agents, including hydrogen peroxide and potassium permanganate, which are known to be inferior disinfectants. This indicates that the cell walls are important factors in preventing entrance of these materials into the cells. The rate of action of these agents is in direct proportion to their rate of penetration through cell walls. HOCl is a superior disinfectant, not merely because of its strong oxidizing power, but because its small molecular size and neutral electrical charge enable it to penetrate cell walls quickly.

HOW MUCH CHLORINE IS NECESSARY

It is believed that sufficient information is now available to enable one to predict with reasonable accuracy whether bacteria will be killed under a given set of conditions. At the large municipal water-treatment plants in the United States this is routinely accomplished with good results. The water usually comes from large, well-developed sources and varies only slightly in composition from season to season. The treatment processes are based on frequent laboratory analyses and are controlled by scientific instruments and skilled operators. Distribution of water to the consumer is through a complex system of pipes. When the distribution system has been properly designed and installed and a continuous positive pressure is maintained, a high degree of protection is provided for the water.

Water supplies at military posts approximate municipal supplies in design and operation but lack the stability characteristic of a municipal system. Camps are built, enlarged, altered, and reduced. Each change in the distribution system, the water-treatment plant, or the plumbing within a building introduces possi-

(9) Greene, D. E., and Stumpf, P. K.: Mode of action of chlorine. J. Am. Water Works Assoc. 38: 1301, 1946.

bilities of contamination. Therefore, a higher residual chlorine level is required at military posts than in most cities.

Conditions in the field are different than in a garrison. Water is taken from the best sources available and is then cleaned and made safe to drink. Water points are moved as the unit advances, and the characteristics of the raw water from a single stream may change from hour to hour. It is not practical to study, analyze, and plan for scientific treatment at each water point. Therefore, blanket requirements are established to guarantee safe drinking water under the expected conditions.

The principal factors taken into consideration in establishing a chlorine residual for field units operating in a specific area and using a wide variety of water sources are:

1. The species and concentration of pathogenic organisms likely to be encountered. The concentration of chlorine required to inactivate or kill bacteria varies from species to species. The cysts, spores, and some of the viruses are the most resistant and require the highest levels. Highly contaminated water demands a higher concentration of chlorine than relatively safe water.

2. The pH of the water and the amount of ammonia present. These two factors determine whether the final form of the chlorine compound is free available chlorine or chloramine. This, in turn, determines bactericidal efficiency.

3. The amount and nature of organic material present in water. Water containing large amounts of organic material requires greater amounts of chlorine. Unoxidized organic material combines with chlorine. Organisms buried in particles may be shielded from the bactericidal action of chlorine. Water that is relatively free of organic material or that has been treated by coagulation, sedimentation, and filtration can be rendered safe with lower concentrations of chlorine than water which contains much organic material.

4. The temperature of the water. The action of chlorine in cold water is much slower than in warm water. With cold water, either a higher level or longer contact time is required to produce the desired result. With the combination of low temperature, high pH, and chloramines as a disinfecting agent, the bactericidal action will be very slow.

5. Contact time. It requires time for chlorine to pass through the bacterial cell walls and kill the cell. With high concentrations of chlorine, this is accomplished quickly and vice versa. In the Army, the contact time is usually accepted as 30 minutes and the residual chlorine adjusted accordingly.

6. Probability of recontamination after treatment. Water susceptible to recontamination should contain sufficient chlorine to kill bacteria quickly, right up to the time the water is consumed.

7. Factors of safety. After all other factors are evaluated, a factor of safety is added to compensate for incompleteness of scientific knowledge, unusual conditions, variations in equipment and supplies, human errors, errors in treatment, and accidental recontamination.

BOOK REVIEWS

Ophthalmic Plastic Surgery, by *Sidney A. Fox*, M. S. (Ophth.), M. D., F. A. C. S., Assistant Clinical Professor of Ophthalmology, New York University Post-Graduate Medical School; Attending Ophthalmologist, Goldwater Memorial and Bronx Veterans Administration Hospitals; Associate Ophthalmologist, Hospital for Joint Diseases; Assistant Surgeon Ophthalmologist, Bellevue Hospital, New York, N. Y. 290 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price $15.

This book is not intended to be an encyclopedia of plastic surgery, but rather a careful explanation of procedures which the author has used and found valuable. Insofar as possible explanation is by illustration rather than by written text. In this respect the book is outstanding. A typical illustration has a photograph of a patient's eyes at the top of the page, then 6 or 8 drawings showing clearly each step in the surgical procedure used in its correction. At the bottom of the page another photograph shows the result obtained. These illustrations are unusually well done and could be followed quite easily by an experienced ophthalmologist. If more than one procedure is described for a condition, complete illustrations are provided for each procedure and the factors to be considered in the selection of each are given.

The field of ophthalmic plastic surgery as performed by the practicing ophthalmologist is well covered. The book includes a brief but adequate review of the fundamentals of plastic surgery, including the anatomy of the brow and lids, fundamentals of operations on the lids, a discussion of skin and mucosal grafts and technical surgical details. This is followed by discussions of canthoplasty; repair of the epicanthus; conditions involving

the lid margins; canthal repairs; operations for entropion, ectropion, ptosis, and displacements of the lid and globe; reconstruction of the conjunctiva, socket, and upper and lower lids; and the use of hair-bearing grafts.

Errors are bound to creep into a book of this type. Several of the illustrations have very minor defects in the outlining of the undermined areas or in suture placement. They are, however, remarkably scarce for a book so profusely illustrated. The described technic of nerve block of the lids is not adequate. The ophthalmic surgeon experienced enough to undertake plastic procedures will already have this information or should get it from another source.

The book is written in direct, very readable style with occasional smile-provoking remarks which serve to hold the interest of the reader. It is highly recommended to the ophthalmologist as a reference on ophthalmic plastic procedures.

—Col. V. A. Byrnes, USAF (MC)

Methods in Medical Research, Governing Board, *Irvine H. Page,* Chairman; *A. C. Ivy; Colin M. MacLeod; Carl F. Schmidt; Eugene A. Stead; David L. Thomson.* Volume V. *A. C. Corcoran,* Editor-in-Chief. Methods for Separation of Complex Mixtures and Higher Molecular Weight Substances, *Lyman C. Craig,* Editor; Methods of Renal Study, *A. C. Corcoran,* Editor; Immunochemical Methods of Determining Homogeneity of Proteins and Polysaccharides, *Melvin Cohn,* Editor. 394 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price $7.50.

The book is divided into 3 sections. The first describes the methods for separating complex mixtures and higher weight molecular weight substances. Complete information on counter current distribution, paper chromatography, electrophoresis, and ultracentrifugation is given. Section 2 gives a broad coverage to applied and experimental methods for renal study. Section 3 discusses the modern methods for immunochemical characterization of proteins and polysaccharides, the production of antibodies in experimental animals, the separation of the antibody-active proteins from animal serums and the technic for analyses of quantitative precipitation reactions.

These sections are self-contained and complete. The scientist interested in one or more of the above areas will find most satisfactory coverage of the methods and technics applicable. In addition to this there is a critical appraisal of the limitations inherent in the technics and a description of recent modifications. All of this should aid the investigator to be as critical of his experimental methods as he traditionally has been in appraising the results or conclusions made possible by use of these experimental methods.—*Lt. Col. F. L. Bauer, MC, USA*

HERETOFORE UNDESCRIBED ORGANISM ISOLATED FROM THE GENITOURINARY SYSTEM[1] [2]

SIDNEY LEOPOLD, *Captain, MSC, USAR* [3]

WHAT appears to be a new bacterium has been repeatedly isolated from the human genitourinary tract. It was primarily isolated only on the modified type of blood agar medium described by Casman [4]. After extensive studies with other dehydrated blood agar bases, this laboratory selected Casman's medium for use in the examination of all specimens submitted for bacteriologic study in which blood was a growth requirement. Samples of urine and cervical smears streaked on this medium and incubated in a 10 percent carbon dioxide atmosphere frequently yielded the organism herein described. It was isolated in pure culture from many specimens, and whenever encountered was the predominating organism. In the 2 years previous to the adoption of Casman's medium this organism was not encountered.

Methods. Urine samples were collected aseptically from men after swabbing the urinary meatus with alcohol. After centrifugation, the sediments obtained were streaked onto Casman's medium. Specimens taken by swab from the cervical os were smeared directly onto the same medium. The inoculated plates were incubated at 37° C. under 10 percent carbon dioxide for 48 hours. Following primary isolation, the organism can be maintained by serial culture in thioglycollate broth.

Description of the organism. The organism is a gram-negative, nonmotile, nonencapsulated, pleomorphic rod 0.5 micron wide and from 0.5 to 2 micra long (fig. 1). It appears as a tiny, pinpoint, colorless, definitely hemolytic colony on Casman's blood

(1) Presented at the meeting of the Allegheny Branch of the Society of American Bacteriologists, Pennsylvania State College, October 1948.

(2) Reviewed by the Veterans Administration and published with the approval of the Acting Chief Medical Director. The statements and conclusions published by the author are the result of his own study and do not necessarily reflect the opinion of the Veterans Administration.

(3) Veterans Administration Hospital, Martinsburg, W. Va., at time of writing; now at Camp Detrick, Md.

(4) Casman, E. P.: Noninfusion blood agar base for Neisseriae, pneumococci, and streptococci. Am. J. Clin. Path. 17: 281-289, Apr. 1947.

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agar after 48 hours' incubation (fig. 2). Although the colony is not visible to the naked eye after 24 hours of incubation, it may be detected at this time by an area of slight hemolysis surrounding it. The colonies may attain a diameter of 0.5 mm. after several transfers. Subculture in thioglycollate broth requires, as

Figure 1. Photomicrograph of pure culture of organisms. X 900.

a rule, a heavy inoculum and 48 hours of incubation. The growth is micro-aerophilic and markedly diminished when methylene blue is employed instead of resazurine as the eH indicator (fig. 3). In this medium the organism remains viable for from

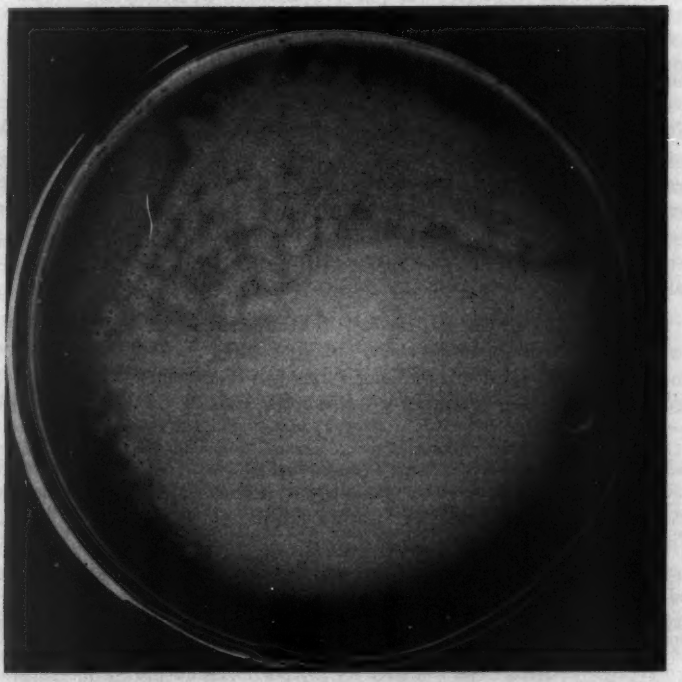

Figure 2. Plate showing 48-hour growth of hemolytic colonies.

5 to 7 days at 37° C. Colonies on blood plates usually must be transferred at the end of 48 hours to maintain viability and will not survive even a 1-day shipment in the mails on this medium. As a base for the determination of fermentation we employed cysteine trypticase agar (5). Acid is produced in glucose, maltose, and dextrin, and some strains show slight acid reaction in xylose and arabinose. Sucrose, lactose, inulin, mannitol, and

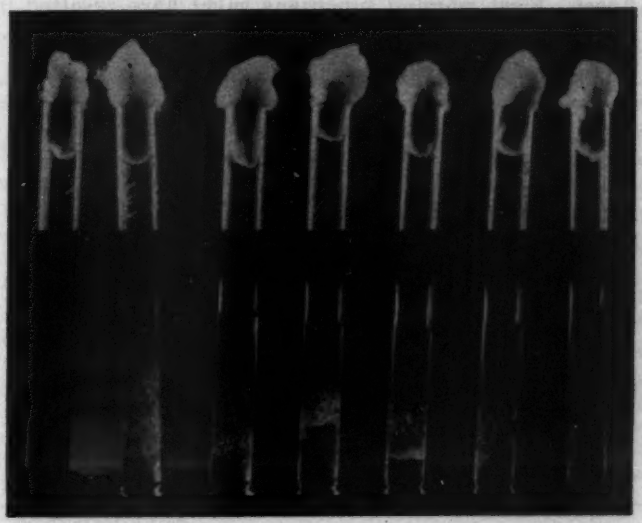

Figure 3. Growth in thioglycollate after 3 to 5 days (eH indicator resazurin).

glycerin are not fermented. The organism does not reduce nitrates and is oxidase-negative with p-aminodimethylaniline monohydrochloride.

Association with clinical symptoms. All men from whom this organism was isolated showed signs of mild to moderate prostatitis, with or without urethritis. In many, the prostatitis was detected by physical examination after the laboratory reported the presence of the organism in the urine specimen. The women from whom this organism was isolated exhibited signs of cervicitis, with or without erosion. Some showed signs of the usual postpartum cervicitis in which no definite symptoms of infectious cervicitis were experienced. This organism has not been isolated from 134 cultures of the upper genitourinary tract. Although the organism has been isolated from bladder specimens taken during cystoscopy, it has never been found in specimens

(5) Vera, H. D.: Simple medium for identification and maintenance of gonococcus and other bacteria. J. Bact. 55: 531-536, Apr. 1948.

taken directly from the right and left ureters. The extent to which the organism was encountered is shown in table 1. The largest number of specimens consisted of routine unselected urines received for bacteriologic examination, but did not include specimens examined after the initiation of therapy. The high percent of positive cultures isolated from the cervix and from the husbands of women with positive cultures seems especially significant. First morning specimens might have resulted in an even higher percent of positive cultures in the last group.

TABLE 1. *Frequency of occurrence of the organism in genitourinary cultures*

Type of specimen	Total number of cultures	Positive cultures	
		Number	Percent
Urine (from men)*	965	53	5.5
Urine from men with previous histories of nonspecific urethritis	18	2	11.1
Cervical swab	58	16	27.4
Urine from husbands of women in series 3 with positive cultures	9	4	44.5
Total	1,050	75	7.2

*Excluding specimens from ureteral catheterization.

DISCUSSION

These data are presented for consideration of the possible role of the organism described in infections of the lower genitourinary tract. A description of the organism has not been found, as yet, in the literature, and identification must await more extensive study of growth requirements, cultural characteristics, antigenic structure and pathogenicity. Certain characteristics, such as growth requirements and microscopic and macroscopic morphology, suggest a close relationship to the genus Hemophilus but contraindicate inclusion in the Mimeae *(6, 7)* tribe. To date, attempts to identify this organism with the pleuropneumonia group by the use of specialized media have been unsuccessful.

(6) DeBord, G. G.: Descriptions of Mimeae trib. nov. with three genera and three species and two new species of Neisseria from conjunctivitis and vaginitis. Iowa State College J. Sc. 16: 471-480, 1942.

(7) DeBord, G. G.: Species of tribes Mimeae, Neisserieae, and Streptococceae which confuse diagnosis of gonorrhea by smears. J. Lab. & Clin. Med. 28: 710-714, Mar. 1943.

MEDICAL PROCESSING OF A NATIONAL GUARD INFANTRY DIVISION(1)

ANTHONY RUPPERSBERG, Jr., *Colonel, MC, NGUS (Ohio)* (2)

COLLINS WIGHT, *Lieutenant Colonel, MSC, USA* (3)

WITHIN the scope of medicomilitary literature, and within the files of various headquarters in the higher echelons, there is a distinct paucity of details concerning the medical processing of a unit of the civilian components for induction into Federal Service. Recently, we supervised and directed administrative measures and professional reviewing of preinduction physical examinations executed on members of the 37th Infantry Division, Ohio National Guard. We believe that a pattern for processing units for extended active duty might prove valuable. We will, therefore, (1) present an organizational program for Army Medical Service officers who may, in the future, be called on to process a large unit of a civilian component for induction into Federal Service, (2) point out the problems encountered during the processing of the 37th Infantry Division, Ohio National Guard, 1951-1952, and (3) present statistics for comparison with those of similar units.

One of us (AR) served as a member of an examining board when the Division was mobilizedon 15 October 1940. Unlike the recent program, the plan 12 years ago called for the medical processing to begin on the induction date. The establishment of preinduction processing constitutes a great improvement.

Numerous changes have also been made in the regulations pertaining to physical standards since 1940. One of the principal improvements was the establishment of the physical profile (PULHES) system, the merits of which appear to both medical and line officers only after using it for a time.

In an effort to obviate many common problems before they appeared, numerous conferences were held with experienced offi-

(1) Presented at the Second Army Surgeon's Annual Orientation Conference for Army Medical Service Officers, Cleveland, Ohio, 15 March 1952, and Cincinnati, Ohio, 16 March 1952.

(2) Chief Surgeon, Ohio National Guard.

(3) Formerly Chief, Medical Section, Ohio Military District.

cers of various branches of the service. We also conducted informal interviews with key persons in various offices of Ohio Military District and the Adjutant General's Department (Ohio) to elicit facts and opinions which would aid in the planning. We hoped that accomplishment of the task would transplant persons as smoothly as possible from their homes and their civilian occupations into a military environment. On the other hand, we knew in advance that individual resentment against an active-duty assignment on the part of certain guardsmen, would occasionally result in malingering and the use of political pressure in their behalf.

PLANNING

We first made an "estimate of the situation" which gave us the following information.

1. Total number of National Guardsmen to be examined: 7,133 (from the morning report, AG Ohio, 1 September 1951).

2. Time allotted: 18 weeks (from 12 September 1951, the date of the alert, to 15 January 1952, the date of induction). The arbitrary deadline for completion of physical examinations was 15 December 1951 and the arbitrary deadline for completion of the typewritten report was 15 January 1952.

3. Examinations would be performed in the towns where National Guard units were located. This would preclude unnecessary travel of personnel from their homes and would eliminate the messing and billeting problem which would be created by ordering large groups to a central location.

4. *Administration.*

a. In April 1951, twelve teams of medical and dental Reserve officers had been organized throughout the State for the purpose of conducting physical examinations on all Reservists under the Army Service Evaluation Program for Reserve personnel. The location of these teams corresponded to the Ohio Organized Reserve Corps (ORC) centers with the exception of the Zanesville Center which was covered by the Columbus Center team. These existing teams would be augmented with National Guard medical and dental officers and civilian physicians. Table 1 shows the location of these teams and the number examined. Fortunately, SR 140-210-10 provided the authority to place Reserve and National Guard medical and dental officers on active duty on a daily basis. Civilian physicians to assist with the examinations, consultants, hospitals, and laboratories would be paid under the provisions of DA Circular 62, 1952.

b. A chart listing the location, officer, warrant officer, and enlisted strength of all components of the 37th Division would be published by the Ohio National Guard headquarters. The chart would indicate which officer-in-charge in each ORC center was responsible for the medical processing of each unit. Columns were totaled to show the number of examinations to be accomplished by each center. The Adjutant General of Ohio would be furnished sufficient copies of the chart for all components of the Division. Distribution also would be made to officers-in-charge, ORC centers. This chart was used by the medical section as a quick method of checking requisitions from ORC centers for medical supplies to see if amounts requested were justified by the total number to be examined.

c. ORC centers would furnish invaluable administrative assistance in co-ordinating and executing movement details.

d. Headquarters, Ohio-Kentucky Recruiting District would offer the use of the examining facilities in Toledo, Cleveland, Columbus, and Cincinnati, Ohio.

e. The Medical Section, Headquarters, Ohio Military District, Fort Hayes, Columbus, Ohio, would serve as a central co-ordinating agency and would review the physical profiles and type all forms. Officers-in-charge, ORC centers would forward single copies, prepared in ink, of Report of Medical Examination (Standard Form 88) and Report of Medical History (Standard Form 89). Headquarters, Ohio Military District, would type required copies and return to officers-in-charge, ORC centers for signatures of medical and dental officers. Officers-in-charge would turn completed forms over to unit commanders for distribution under the provisions of SR 130-10-1, "National Guard, Ordered into Active Military Service of the United States, 14 August 1951."

MODUS OPERANDI

Processing procedures. Plans completed, the processing of the examinees was set into operation. The project began on 20 September 1951 and continued through 22 January 1952. All the medical examinations were accomplished by the respective examining teams. The physical standards prescribed by AR 40-115 ("Physical Standards and Physical Profiling for Enlistment and Induction, 1948) were used in the processing of enlisted men and those prescribed by AR 40-105 ("Standards of Physical Examination for Commission or Warrant in Regular Army, National Guard of the United States, Army of the United States, and Organized Reserve Corps," 1948, and changes 1 and 2, 1951) were used in the processing of officers.

Following the general medical processing procedures, each examinee was required to fill out his own "Report of Medical History" (Standard Form 89), which was reviewed by the physician performing the examination and commented on by him when indicated.

The medical findings with respect to each examinee were reported on the "Report of Medical Examination" (Standard Form 88) used as a medical work sheet. Standard Form 88 and Standard Form 89 were forwarded on completion of the examination to the Medical Section, Ohio Military District Headquarters, where they were reviewed by a Medical Service Corps officer for completeness and then by a board of 3 medical officers.

A large number of these forms were returned after review to the local examining teams for re-evaluation of the medical findings or because of incomplete recording. This procedure was definitely time consuming, but unavoidable. About half of this number were returned because such defects as missing toes or fingers, appendectomies, et cetera, which had been reported by the examinees were not accounted for by the examining physician on the Standard Form 88. In other instances, the medical personnel had failed to comment in their summaries of Standard Form 89 on pertinent defects, such as positive answers by the examinee to homosexual tendencies, drug addiction, history of suicide, et cetera. Among the forms returned were also those with borderline findings requiring consultation with a specialist before a determination of acceptability could be made. The number of examinations, consultations, and forms returned are shown in table 1.

As indicated in the table, 1,520 consultations were accomplished either at the time of initial examination or after the forms had been returned by the medical section to the examining teams for further evaluation. The examining teams which accomplished proportionally larger numbers of consultations prior to the initial forwarding of the examination forms to the medical section had relatively fewer forms returned for re-evaluation.

After the returned forms were reviewed by the examining teams they were sent back to the medical section for a final determination of physical fitness. The forms of persons whose fitness was still regarded by the medical section as borderline because of minor defects were forwarded to the Surgeon, Second Army, for waiver. In some instances, the defects were of such a nature that the Second Army forwarded the forms to the Department of the Army for final action. This was time consuming, but proved very effective in that an examinee accepted on a waiver might be reasonably sure of being considered physically qualified for promotion, et cetera, at a later date. Of the 880 examinees (12 percent

TABLE 1. *Number of examinations, consultations, and examination forms returned*

Location of examining team	Number			Percent	
	Examination*	Consultations	Forms returned	Consultations	Forms returned
Akron	442	25	65	5.7	14.7
Canton	250	55	60	22.0	24.0
Cincinnati	1,183	263	246	22.2	20.8
Cleveland	1,473	134	121	9.1	8.2
Columbus	986	242	25	24.5	2.5
Dayton	685	84	119	12.3	17.4
Lima	787	193	175	24.5	22.2
Mansfield	311	57	42	18.3	13.5
Portsmouth	29	12	10	41.4	34.5
Steubenville	37	-	22	-	59.5
Toledo	959	408	102	42.5	10.6
Youngstown	253	47	18	18.6	7.1
Total	7,395	1,520	1,005	20.6	13.6

*Of the total 7,329 examinees, 66 persons were examined twice.

of the total number) who were granted waivers, 724 were overweight, 105 were underweight, and 51 had other defects.

Preparation and routing of the medical forms. After final determination was made by the medical section with respect to the examinee's acceptability, Standard Forms 88 were ready for typing. In the case of qualified examinees, an original and 2 carbon copies were typed. All typed copies of Standard Form 88 and the single copy of Standard Form 89 were returned through the respective officer-in-charge, ORC, to the examining teams for signature. After the forms were signed, they were forwarded through the officer-in-charge, ORC, to the unit commanders for distribution, as follows: The original of Standard Form 88 and Standard Form 89 to the unit file; 1 copy to the Adjutant General, Ohio; and 1 copy to the Adjutant General, U. S. Army. In the case of disqualified examinees, an additional copy of Standard Form 88 was prepared, which was given to the examinee. This procedure was also followed with respect to examinees requiring waivers, because it obviated the necessity of preparing a true copy in the event the waiver was not granted.

The initial routing of the typed forms in case of disqualified examinees was the same as for qualified personnel, but the signed forms received by the officer-in-charge, ORC, were forwarded to the Adjutant General, Ohio, for final distribution because this headquarters published the discharge orders on men separated from the Division prior to the date of federalization. The Adjutant General, Ohio, forwarded in turn the original Standard Forms 88 and 89 to the Adjutant General, U. S. Army, and 2 copies to the unit commander (1 for the unit file and 1 for the examinee). One copy of Standard Form 88 remained in the file of the Adjutant General, Ohio. In all cases, the medical work sheets (Standard Form 88) were retained by the medical section.

Personnel involved. The huge proportions of the prospective operation were revealed soon after the processing began. A total of 478 persons contributed 1 day or more of work toward the completion of the task (table 2). Of the personnel involved in the project throughout the State, 314 (65.7 percent) were physicians or dentists and 164 (34.3 percent) were administrative personnel. As of 14 January 1952, 7,395 medical examinations and 1,520 consultations had been accomplished; 95 medical examinations were performed after 14 January 1952, bringing the total to 9,010 medical examinations and consultations.

Administrative activity of the medical section. During the first 2 months of processing, this office first concentrated primarily on reviewing the physical examinations forwarded by the examining teams. No physical examinations were typed in September and October because the 4 available typists were engaged

TABLE 2. *Personnel involved in the processing of the examinees*

Location of examining team	Medical and dental personnel				Administrative personnel			Total
	Examining		Consulting					
	Officers	Civilians	Officers	Civilians	Officers	Enlisted men	Civilians	
Akron	8	-	-	5	6	6	-	25
Canton	7	2	5	25	4	5	-	48
Cincinnati	10	6	3	6	1	50	-	76
Cleveland	5	14	2	11	1	1	-	34
Columbus	16	8	6	16	4	19	28	97
Dayton	7	-	-	-	-	-	-	7
Lima	4	6	2	20	1	2	1	36
Mansfield	5	12	3	7	1	-	-	28
Portsmouth	3	4	1	2	1	2	-	13
Springfield	10	-	7	-	3	3	-	23
Steubenville	3	-	-	3	4	6	2	18
Toledo	8	5	6	7	2	-	-	28
Youngstown	5	12	5	12	4	3	4	45
Total	91	69	40	114	32	97	35	478

in endorsing requests for extended active-duty orders, or in preparing letters of transmittal for returned forms (table 3). During this period, the medical section was under pressure to review at once physical examinations of key personnel. Thirty or more local and long-distance telephone calls per day were received from members of the 37th Division who desired information as to whether or not they were physically qualified so they could arrange their personal affairs.

TABLE 3. *Processing at the Medical Section, Headquarters of Ohio Military District, by month*

Month	Standard Forms 88		Requests for EAD**
	Reviewed*	Typed*	
September 1951	407	0	407
October	1,872	0	1,872
November	2,730	626	1,963
December	3,147	4,773	197
January 1952	125	1,982	86
February	28	14	0
Total	8,309	7,395	4,525

*7,329 men were examined, of whom 66 were examined twice (7,395 forms). In addition, 914 physical examination forms were reviewed twice, constituting a total of 8,309 reviewed forms.

**Indicates the number of requests for extended active duty orders matched with physical examination papers of persons who entered on EAD prior to 15 January 1952. Orders were not published by the Ohio Military District until requests for orders were endorsed by the medical section indicating qualifications for EAD.

A total of 407 examinations were reviewed for personnel ordered to active duty in September to attend service schools and duty as members of advanced parties. The peak load of typed examinations was reached in December, necessitating the temporary transfer of 12 typists from other staff sections and the detailing of 8 enlisted men to work 3 hours each evening throughout December and the first 2 weeks of January. The average time required by this office to process a medical examination form was estimated to be about 2½ hours.

PROGRESS

By 1 December, it was apparent that the 15 December deadline for completion of the physical examinations could not be met; 526 men had failed to report for their examinations and 425 physical examinations were in the hands of the examining teams for additional information. The Adjutant General, Ohio, requested that completed copies of the physical examination be furnished the components of the 37th Division by 1 January 1952. This date was 2 weeks earlier than our original target date for com-

pletion of the administrative portion of the project. Thereupon, the Chief of the District directed that processing of the Division would have priority over all other work. Authority to pay civilian typists for overtime work was granted. Personnel were intensely co-operative in volunteering many extra hours of work. By 1 January 1952, all physical examination forms on hand in the medical section had been typed and forwarded. The task could not be considered completed because many forms were at Headquarters, Second Army, for decision as to waiver or had been returned to examining teams. On 14 January, 555 examination forms were pending final action, 249 of these were in the hands of teams for additional information, 151 were at Headquarters, Second Army, for decision as to waiver, and 155 members of the Division had failed to report for examination. Fifty-three members failed to complete their physical examination prior to departure for Camp Polk. On 1 April, 48 examinations had not yet been completed and on 21 May the 37th Division had not completed all of these examinations.

PROBLEMS

1. There was a constant demand, especially during October and November, for "emergency examinations" to determine the qualification of persons ordered to active duty prior to the federalization of the Division.

2. Daily, there appeared in the office of the Medical Section, Ohio Military District, commanding officers who wished to know at once the status of key men in their respective commands.

3. There were daily requests concerning examination results on men who were constitutents of certain legislators. In some instances, the legislator believed physical disqualification would give his man a more acceptable status in his community than an administrative release due to hardship. Although pressure was placed on the reviewing board to disqualify men whose examinations qualified them for general duty, it conscientiously evaluated every case in the light of the medical history, physical findings, laboratory examinations, and consultants' reports.

4. The following groups of examinees presented an important problem.

a. The examinee who sincerely desired to enter active duty with the Division, but who had physical defects or a history of defects which were disqualifying. These men often attempted to conceal their defects.

b. The examinee who was aware of existing physical defects and desired extended active duty with the sole purpose of attempting to claim that the defect was a result of his

tour of active duty in the hope of receiving compensation from the Government.

c. The examinee who hoped to avoid active duty by feigning physical defects. When this was suspected our first step was to review his last annual National Guard physical examination. Many examinees with disqualifying defects on *preinduction* physical examinations were found to have passed a physical examination for *promotion* with flying colors in August 1951.

5. Personnel in some instances refused to be examined until after the Division was federalized. Technically, they were within their rights, but it caused an annoying delay in the preinduction physical processing.

6. A number of examinees, on advice of their unit commanders, proceeded to service schools without official written orders. On receipt of written request for retroactive active-duty orders, the medical section, on review of the physical examination, discovered disqualified personnel among these men. Recall from the school was then necessary.

7. An inactive guardsman, who was residing in Oklahoma, was recalled. On arrival in Ohio with his family, his commanding officer directed him, with his concurrence, to enter on active duty at once to assist with the administrative duty in conjunction with preinduction processing of the unit. The commanding officer assured the officer that retroactive orders would be published placing him on active duty. For about 1 month, he worked dili-

TABLE 4. *Results of examinations as of 14 January 1952*

	Number	Percent
Qualified: Total	6,657*	90.8
Outright	(6,547)	(89.3)
Temporarily disqualified but qualified on re-examination	(110)	(1.5)
Disqualified: Total	672	9.2
Outright	(509)	(6.9)
Temporarily disqualified and disqualified on re-examination	(151)	(2.1)
Temporarily disqualified	(12)	(0.2)
Total	7,329	100.0

* Includes 880 men on whom waivers were granted.

TABLE 5. *Distribution of disqualified examinees by cause of disqualification and order of frequency*

Disqualifying cause	Sole cause		Sole cause and in combination with other causes	
	Number	Rate per 1,000 examinees	Number	Order of frequency
Psychiatric	119	16.2	166	1
Hernia; ulcers and other gastrointestinal diseases	64	8.7	72	2
Lower extremities	48	6.5	66	3
Spine and other musculoskeletal diseases	34	4.6	45	4
Lungs and chest	28	3.8	36	5
Heart	27	3.7	41	6
Blood pressure	25	3.4	38	7
Roentgenogram of chest	21	2.9	28	9
Vision	21	2.9	27	10
Upper extremities	20	2.7	29	8
Other defects		36.2		
Total		91.6		

gently but on physical examination he was found to be disqualified. Activy-duty orders could not be published, and because there was no provision for the Army or the National Guard to pay him for his duty, it was necessary for him to present a summary claim to the Ohio legislature.

These were only a few of the problems encountered.

RESULTS OF EXAMINATIONS

Perhaps the most gratifying feature of this project, a feature which compensated in a way for the diligence and toil expended by the personnel involved in the task, was the statistical material (tables 4 and 5) that evolved. Sixty-six men were examined twice. The findings were the same in both examinations. The most frequent cause for disqualification was some form of psychiatric condition. It is our opinion that most examinees who had some psychiatric disqualifying condition, either actively or indirectly, were eliminated by this examination. Many were discovered either through symptoms listed by the examinee on his Standard Form

89, or by other signs revealed on the Standard Form 88. The diagnosis in each case was confirmed by psychiatric consultation.

The prevalence rate of syphilis, as detected by positive serologic tests, provided interesting statistics for comparison. Studies made on selectees of World War II showed a rate of 30.1 per 1,000 selectees for the State of Ohio (*4*). A similar study, carried out in Ohio in 1949, showed a rate of 8.1 per 1,000 (*5*). The present examination showed a rate of 6 per 1,000. This remarkable drop is probably due to: (1) general education of the public with resulting improvement of public co-operation in syphilis surveys and prompt treatment of cases discovered; (2) the advent of shorter courses of treatment of syphilis through the use of antibiotics; and (3) the fact that the examinees represented a selected group. Unfortunately, no statistics concerning this division in past years are available for comparison.

NOTICE OF PHYSICAL QUALIFICATION

This card will notify you whether you are qualified or disqualified for general duty. Follow instructions carefully:

1. Place your full name and present mailing address on the reverse side. Your present organization on this side.

2. Attach this card to the forms you filled out for physical examination.

3. After the card has been returned to you DO NOT MISPLACE IT. You will need it should you be selected for a service school or to be placed on extended active duty prior to federalization of your unit.

You are physically ☐ qualified ☐ disqualified

Present organization_____

Medical Reviewing Officer

Figure 1

RECOMMENDATIONS

1. Members or recruits of the National Guard should be more carefully screened prior to initial commission or enlistment because an initial disqualification of a physically unfit man saves funds required to support him during training periods and frees a vacancy which may then be filled by a qualified man.

2. Standard Form 89 should be used in conjunction with all National Guard physical examinations because it requires the

(*4*) Vonderlehr, R. A., and Usilton, L. J.: Syphilis among men of draft age in United States; analysis of 1,895,778 serologic reports of men aged 21-35 who were examined under Selective Training and Service Act of 1940. J. A. M. A. 120: 1369-1372, Dec. 26, 1942.

(*5*) Freeble, C. R.; Wright, E. O.; Donohue, J. F.; and Bolin, J. B.: Ohio National Guard blood-testing program. J. Ven. Dis. Informa. 31: 231-234, Sept. 1950.

examinee to certify to the presence or history of many conditions which would indicate disqualification and which might easily be overlooked by the examining physician.

3. A post card (fig. 1) should be given to the examinee at the time of his preinduction physical examination. When the result of his examination is established, the medical reviewing officer indicates qualification or disqualification on the card and mails it to the examinee through his unit commander. Thus, both the unit commander and the examinee know the results of the physical examination. This advanced information will aid the examinee in arranging his personal affairs and enables his unit commander to make plans to utilize or replace him in the unit.

4. The names and number of persons who enter extended active duty prior to the federalization of the unit for the purpose of attending service schools should be made known at an early date. The physical examinations of this group should be given first priority. In the event of disqualification, the State Adjutant General should be notified in writing. He could then publish discharge orders.

5. Unit commanders should initiate a system whereby closer check could be maintained on personnel of their respective commands in order to bring them to examination or to take administrative action against them when they purposely avoid the scheduled examination by the medical examining team or consultant.

6. No man should be placed on active duty by verbal orders, and written orders should be published only after the examinee's physical examination has been reviewed and he is found to be physically qualified for general duty.

DISCUSSION

Alvin L. Gorby, *Brigadier General, MC, USA (6):* I consider this study a valuable guide for all personnel concerned with the medical processing of any large unit of the civilian components into Federal service. I concur fully with the recommendation of the authors, especially with the need for more careful medical screening. The loss of better than 9 percent for medical reasons seems high and certainly is not economical. Careful initial examinations with periodic reprofiling should markedly reduce this figure.

The preinduction medical processing of this Division resulted in the least possible economic and personal distress for the physically disqualified and eliminated uncertainties in regard

(6) Surgeon, Second Army.

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to induction. The fine teamwork and liaison between the Ohio Military District Headquarters and The Adjutant General of Ohio in successfully completing these examinations prior to induction resolved many problems for the Second Army Headquarters, particularly the Medical Section.

BOOK REVIEW

X-Ray Diagnosis of Chest Diseases, by *Coleman B. Rabin,* M. D., Assistant Clinical Professor of Medicine, College of Physicians and Surgeons, Columbia University; Associate Physician for Chest Diseases and Associate Radiologist, Mt. Sinai Hospital; Consulting Physician for Chest Diseases, Beth El Hospital; Senior Consultant for Chest Diseases, Veterans Administration. 208 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1952.

This book is a reprint of a section from Golden's "Looseleaf Diagnostic Roentgenology" with the same page numbers used in that text. This system of page numbering is confusing at times. The book is divided into 4 parts. In the first part, "General Considerations," the author discusses the uses and limitations of x-ray in diseases of the chest, roentgenographic technic, special examinations, fluoroscopy, and the anatomy of the lungs. His discussion on the limitations of x-ray in the diagnosis of pulmonary diseases is thorough and instructive. In Part II, "General Roentgen Pathology," the normal chest, the author's method of examining the roentgenogram, and pathologic shadows are described. The pathologic changes in each disease from the first to the far-advanced manifestations are discussed followed by an explanation of why the tissue changes cause the shadows seen on the film. Part III, "Regional Roentgen Pathology," deals with each of the anatomic parts of the chest except the heart. The diseases of these parts are described fully. In Part IV, "Differential Diagnoses of Certain Roentgen Shadows," there is much repetition of material covered in the other parts of the text. In a way this section is a synopsis of the differential diagnostic points for certain types of shadow which are associated with those conditions that cause the most difficulty in interpretation. A separate bibliography for each of the sections is given in the back of the book. There is a good index. This is an ideal book for the internist and the young roentgenologist. It should be in all hospital libraries.

—*Commander E. P. McLarney, MC, USN*

PLASTIC REPAIR OF THE EYELID[1]

BERNARD N. SODERBERG, *Colonel, MC, USA*
WILLIAM T. SICHI, *Colonel, MC, USA*
HAL B. JENNINGS, Jr., *Lieutenant Colonel, MC, USA*

THIS article will stress early skin grafting for the burned eyelid and the necessity of fusing the palpebral margins. In the 2 cases reported, there was marked ectropion of the eyelids following third degree burns. The repair was accomplished by free grafts applied to the eyelids and tarsorrhaphy. This procedure appears not to be well known because patients with cicatricial ectropion and corneal ulcer following similar burns are still seen. This latter complication is associated with mild sequelas or, depending on superimposed infection, varying degrees of visual loss. The resulting blindness demands elimination of the etiologic factor.

CASE REPORTS

Case 1. A 22-year-old soldier sustained second and third degree burns of the face and extremities (fig. 1). On admission to this hospital, his wounds were healed. The early skin surfacing accomplished prior to admission showed the usual defects of cicatrix associated with this phase of treatment. The exception was the severe ectropion of all eyelids, permitting chronic exposure of the cornea. Bilateral corneal ulcers were present. Surgical correction for the defect in the eyelid was accomplished 12 days after admission to the plastic and eye section. At operation all limiting cicatrix was excised from the lids, permitting complete mobilization. Skin grafts were substituted for the destroyed surface and tarsorrhaphy was performed immediately.

Case 2. This patient had a marked involvement of one upper lid. This area was grafted shortly after the initial trauma but no tarsorrhaphy was performed. The postoperative appearance is shown in figure 2A. The skin graft had contracted to such an extent that the patient could no longer close his eye. There was ectropion with eversion of the conjunctiva. The intrapalpebral area of the eye globe, being unprotected, was in danger of ulceration. The contracted skin graft was excised and a three-quarter thickness skin graft from the base of the neck fitted into the recipient site. A tarsorrhaphy was performed.

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(1) Brooke Army Hospital, Fort Sam Houston, Tex.

Figure 1. (A) *Preoperative appearance showing marked cicatricial ectropion of all eyelids.* (B) *Appearance after skin graft and tarsorrhaphy.*

DISCUSSION

The free graft is the most satisfactory coverage for eyelids having large surface defects. Several donor sites are available. Each is examined to determine which has the best color match. For small losses the graft could come from another eyelid and this would give the best appearance and function. Grafts from the retroauricular area are satisfactory because the skin there

Figure 2. (A) *Preoperative appearance showing the result of skin graft without tarsorrhaphy (marked ectropion with eversion of conjunctiva).* (B) *Appearance after the original skin graft was excised and the lid was mobilized and resurfaced. Tarsorrhaphy sutures are shown around rubber tubes.*

is thin and of good texture. Ordinarily, however, these transplants are too light in color, appearing as white patches. The supraclavicular area has a color which compares favorably with that of the face. The inner aspect of the upper arm has also been used. The skin graft from this area can be cut with the dermatome.

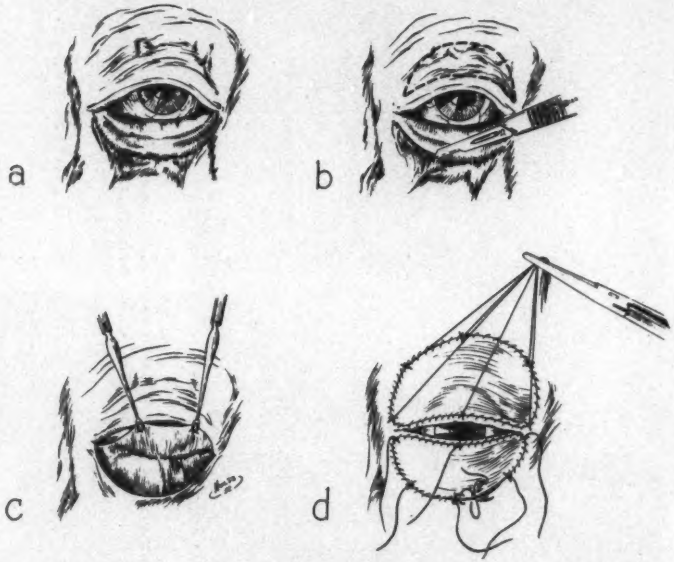

Figure 3. (a) *and* (b) *Areas of cicatrix which were removed from patient 1.* (c) *Scar excised.* (d) *Both lids resurfaced (long sutures to be tied over stent dressing).*

If the principles of proper skin grafting are followed, they will always take. A piece of skin a little larger than the defect to be covered is removed and is tailored to fit the defect as it is sutured in place. Care of the skin graft is important. It should never be dropped into saline solution before transfer nor should it be allowed to dry out. It should be handled gently with skin hooks and suspension sutures. Thumb forceps crush tissue. All scar is removed (fig. 3, a, b, and c) in preparing the recipient site, avoiding injury to the orbicularis oculi muscle, levator palpebrae superioris, or canthal ligaments. Traction sutures through the rim stabilize the structure for operation. The graft is apposed to the bed as soon as complete mobilization and hemostasis are accomplished, Continuous sutures unite the skin edge to the transplant border. Interrupted sutures are tied over the stent for graft fixation (fig. 3d and fig. 5b).

Tarsorrhaphy is performed just prior to stent fixation. Intermarginal adhesions have held fairly well but do not offer the resistance to contraction that tarsorrhaphy does. With the former method the lids are handled with a biprong forceps, then a Graefe cataract knife is used. The proper areas are denuded, avoiding

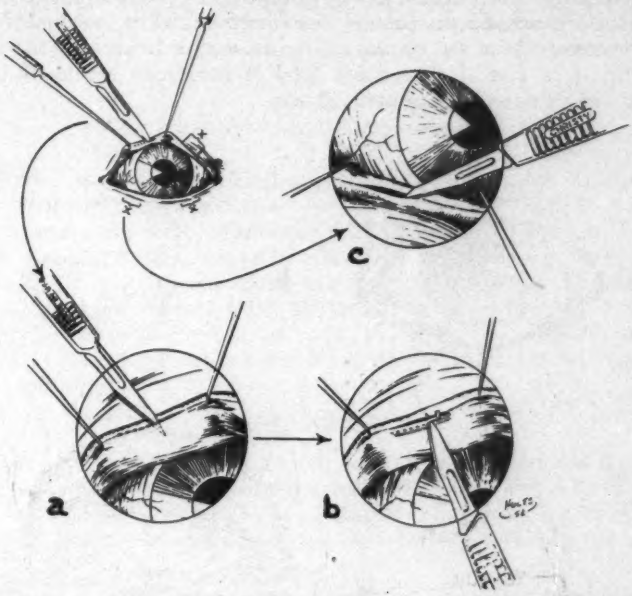

Figure 4. Diagram showing technic of tarsorrhaphy. (a) *and* (b) *Incision into gray line and excision of border conjunctiva on the posterior lamina.* (c) *Corresponding incision in lower eyelid.*

the puncta lacrimalia. Two areas are prepared, one on each side of the pupil, between it and the canthus. Anatomically the lower puncta is further out on the lid than the upper. This must be borne in mind in order to place the excisions in the correct location. Through-and-through mattress sutures hold the lids together. The sutures are tied over rubber pegs. If no eye is present, it may be well to use a plastic conformer. This would be left in the cul-de-sac. A more extensive tarsorrhaphy would be accomplished in this situation. Our experience has shown that intermarginal adhesions have not been satisfactory. In inexperienced hands, one of two complications ordinarily occurs—either too little tissue is removed and adhesions are inadequate, or too large an area is excised with subsequent coloboma. An alternative method is recommended (figs. 4 and 5). This technic provides paramedian intermarginal adhesions strong enough to re-

sist skin-graft contracture. It is a modification of Wheeler's angle tarsorrhaphy. The lid is placed on tension using dural hooks. The incision, made through the intermarginal line, is carried to a depth of 3 mm. in 2 areas from 5 to 6 mm. wide on each side of the pupillary space (fig. 4). The incision is made in the gray line avoiding the lashes. In contradistinction to Wheeler's method, no lashes are removed. The conjunctiva is then removed from the border of the posterior lamina of the upper lid (fig. 4, a and b). The same type of incisions are made in the lower lid adjacent to the ones above.

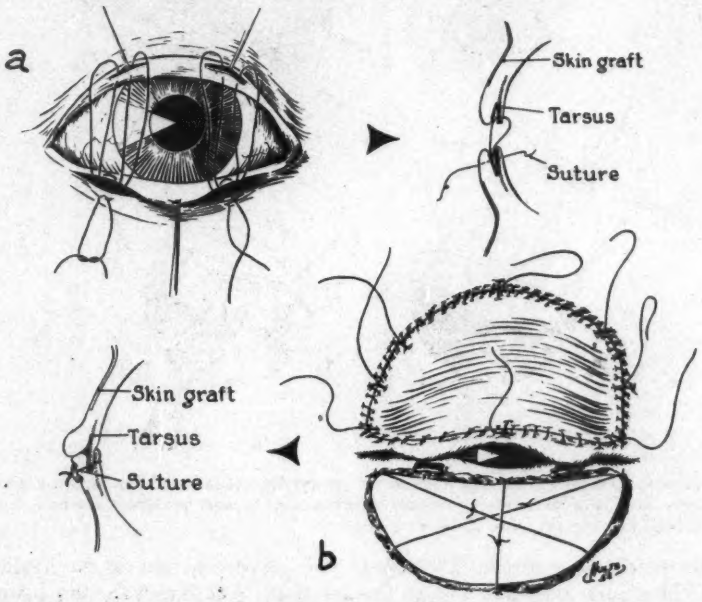

Figure 5. Diagram showing (a) *mattress sutures inserted to approximate the lid margins.* (b) *Sutures tied over rubber or plastic pegs for fixation.*

The flap of tissue so formed includes the tarsal plate. Double-armed sutures (No. 0000 silk) are "mattressed" through the conjunctival surface of the lower lid (fig. 5a). The two ends pass out through the slit extending upward. They pass through the denuded flap of the upper lid and are carried down through the slit of the lower lid and out through the anterior lamina. These sutures (fig. 5b) are tied over rubber or plastic tubing. This anchors the tarsal plate of the upper lid firmly between the lips of the slit in the opposite lid. The sutures are removed in from 5 to 7 days. The intermarginal adhesions remain for from 6 to 12 months.

FATAL BACTERIAL ENDOCARDITIS DUE TO STAPHYLOCOCCUS AUREUS

DAVID B. CARMICHAEL, Jr., *Lieutenant, MC, USN (1)*

THE appearance of effective chemotherapeutic agents has altered many aspects of bacterial infection and as a result acute bacterial endocarditis has become uncommon. On the other hand, certain bacteria naturally resistant or poorly suppressed by our present drugs are flourishing *(2-11)*. The appearance of two cases of fatal acute bacterial endocarditis due to hemolytic *Staphylococcus aureus* in a 6-month period at this hospital has highlighted some of the problems resulting from this situation.

CASE REPORTS

Case 1. A 46-year-old man noted generalized malaise one forenoon. This persisted throughout the day. He retired early and was awakened by a severe chill followed by fever and sweats. His wife stated that he was delirious during the night.

(1) U. S. Naval Hospital, Great Lakes, Ill.

(2) Bondi, A., Jr., and Dietz, C. C.: Penicillin resistant staphylococci. Proc. Soc. Exper. Biol. & Med. 60: 55-58, Oct. 1945.

(3) Barber, M., and Rozwadowska-Dowzenko, M.: Infection by penicillin-resistant staphylococci. Lancet 2: 641-644, Oct. 23, 1948.

(4) Nichols, D. R., and Needham, G. M.: Aureomycin in treatment of penicillin-resistant staphylococcic bacteremia. Proc. Staff Meet., Mayo Clin. 24: 309-316, June 8, 1949.

(5) Beigelman, P. M., and Rantz, L. A.: Clinical importance of coagulase-positive, penicillin-resistant Staphylococcus aureus. New England J. Med. 242: 353-358, Mar. 9, 1950.

(6) Herrell, W. E., and Wellman, W. E.: Symposium on medical therapeutics; current use of penicillin and streptomycin. M. Clin. North America 34: 319-330, Mar. 1950.

(7) Levinson, D. C.; Griffith, G. C.; and Pearson, H. E.: Increasing bacterial resistance to antibiotics; study of 46 cases of streptococcus endocarditis and 18 cases of staphylococcus endocarditis. Circulation 2: 668-675, Nov. 1950.

(8) Romansky, M. J.; Fusillo, M. H.; Caldwell, E.; and Robin, E. D.: Synergistic action and potential applications of antibiotic combinations. M. Clin. North America 35: 535-544, Mar. 1951.

(9) Spies, H. W.; Dowling, H. F.; Lepper, M. H.; Wolfe, C. K.; and Caldwell, E. R., Jr.: Aureomycin in treatment of bacterial endocarditis; report of 9 cases together with a study of synergistic action of aureomycin and penicillin in 1 case. Arch. Int. Med. 87: 66-78, Jan. 1951.

(10) Editorial: Bacterial versatility. Ann. Int. Med. 36: 196-202, Jan. 1952.

(11) Glaser, R. J., and Smith, D. E.: Clinico-pathologic conference. Am. J. Med. 13: 82-89, July 1952.

Shortly after midnight he took 3 APC tablets and the symptoms lessened in intensity. In the morning he felt fatigued, and when he had another chill, at noon he entered the hospital. He had been examined yearly throughout his naval career and at no time were abnormal cardiac findings noted.

Physical examination on admission revealed an acutely ill, moderately dehydrated man with a temperature of 103.4° F. and a pulse rate of 100. No skin lesions were noted. His heart was not enlarged. A grade 2, blowing systolic murmur was noted at the apex and along the left sternal border. His aortic second sound was not abnormal. His blood pressure was 115/65. His leukocyte count at 1430 hours on the day of admission was 18,900 with 81 percent polymorphonucleocytes and 7 percent band forms. Another count 3 hours later was 13,900 with 77 percent polymorphonucleocytes and 15 percent band forms. Blood cultures revealed hemolytic *Staph. aureus,* coagulase positive. His leukocyte count on the next day was 12,500 with 80 percent polymorphonucleocytes and 8 percent band forms.

On admission, fluids were forced orally and intravenously and salicylates were given. During the first 4 hours of hospitalization he showed general improvement, but about 5 hours after admission his temperature rose to 105° F. and he became delirious. He complained of severe headache. After being sponged and given more fluids intravenously, his temperature fell to 103° F. and he became rational and comfortable. During the night he became disoriented, irrational, and incontinent. Again he complained of headache during his short lucid intervals. A neurologic examination revealed loss of tone in the right upper extremity, variable toe signs, and absent superficial reflexes. A spinal tap was performed and the fluid was not noted to be under increased pressure. The spinal fluid contained 130 mg. of sugar and 40 mg. of protein per 100 cc.; and 18 erythrocytes and 7 leukocytes per cu. mm. The neurologic consultant made a tentative diagnosis of acute encephalitis. In the evening of the day following admission a small abscess of the skin overlying the ventral aspect of his right great toe, and small subconjunctival petechias were noted. Aureomycin was given intravenously but his condition continued to fail and he died at midnight of the second day of hospitalization.

Autopsy revealed petechial hemorrhages over the epicardium. The aortic valve was bicuspid, with both cusps extensively involved with calcification and atheromatosis. On one valve there was ulceration, apparently of an atheromatous plaque. On the other, on the aortic side, there was a similar ulceration with a fibrin vegetation. Elsewhere on both valve cusps were scattered small, red, friable, verrucose vegetations. Septic emboli to the

myocardium with suppurative myocarditis and early pericarditis were noted. A septic embolus to the right cerebral hemisphere with massive intracerebral and intraventricular hemorrhage was found. There were disseminated septic emboli to the skin and small intestines. Microscopic sections of the aortic valve revealed large masses of purple-staining cocci in the areas of ulceration. The vascular portions of the valve and its attachments contained an inflammatory exudate chiefly of polymorphonucleocytes.

A blood culture obtained post mortem revealed hemolytic *Staph. aureus*, coagulase positive. Postmortem cultures from the brain, aorta, urine, and abscesses in the bowel wall were all positive for the same organism. This organism was resistant to terramycin, chloramphenicol, penicillin, gantrisin, sulfathiazole, sulfadiazine, and sulfamerazine. It was sensitive to bacitracin, aureomycin, and streptomycin.

Comment. The clinical course was typical of acute bacterial endocarditis due to *Staph. aureus*. Characteristically it is a virulent, overwhelming infection leading rapidly to death *(12)*. The localization on the aortic valve also is typical because most of such infections are seated on either the aortic or mitral valves *(13)*. Although much less characteristic than in *subacute* bacterial endocarditis, the site of infection on an abnormal cusp conforms to the expected pattern *(14, 15)*. Bacterial endocarditis involving a bicuspid aortic valve has been reported by others *(16, 17)*. Confusion with acute encephalitis is not frequent; but the clinician must expect any syndrome which might result from bacterial embolization and infection throughout the entire systemic circulation. One case was reported in which the clinical diagnosis was cerebral thrombophlebitis with cerebral infarction, and another in which an ante-mortem diagnosis of meningitis was considered *(18, 19)*.

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(12) Harris, W. H., Jr., and Fishburn, G. W.: Subacute Staphylococcus aureus endocarditis; recovery following combined antibiotic therapy. Am. Heart J. 43: 474-478, Mar. 1952.

(13) Goldburgh, H. L.; Baer, S.; and Lieber, M. M.: Acute bacterial endocarditis of tricuspid valve. Am. J. M. Sc. 204: 319-324, Sept. 1942.

(14) Libman, E.: Characterization of various forms of endocarditis. J. A. M. A. 80: 813-818, Mar. 24, 1923.

(15) Friedberg, C. K.: Diseases of the Heart. W. B. Saunders Co., Philadelphia, Pa., 1949.

(16) Koletsky, S.: Congenital bicuspid aortic valves. Arch. Int. Med. 67: 129-156, Jan. 1941.

(17) Mazar, S. A., and Brown, N.: Bicuspid aortic valves and bacterial endocarditis. New York J. Med. 52: 1295-1298, May 15, 1952.

(18) Mallory, T. B. (editor): Case 26182. In Case Records of the Massachusetts General Hospital. New England J. Med. 222: 769-771, May 2, 1940.

(19) Mallory, T. B. (editor): Case 27522. In Case Records of the Massachusetts General Hospital. New England J. Med. 225: 1026-1028, Dec. 25, 1941.

Case 2. A 20-year-old man, who was in good health until 3 days prior to admission, noted pain and tenderness in the coccygeal area. He was examined and told that he had a pilonidal cyst. Diathermy was given with no improvement. On the day prior to hospital entry a draining sinus appeared.

Physical examination on admission revealed a large, fluctuant mass in the midline between his gluteal folds. Three draining sinuses were seen. His temperature was 99.4° F. The leukocyte count on admission was 8,250. At no time did it exceed 15,800. The Arneth count consistently was shifted to the left. On admission the hemoglobin was 16 grams per 100 cc. A moderate normochromic anemia developed and frequent blood transfusions were given to keep the hemoglobin at about 12 grams per 100 cc.

Aureomycin was given in doses of 250 and 500 mg. q. i. d. On the day following admission, incision and drainage of the abscess was performed. Five days later, under low spinal anesthesia, the sinus was unroofed and marsupialized. The patient tolerated the procedure well, and postoperatively bacitracin packs were applied to the wound. On the first postoperative day he had a small amount of bleeding from the wound and his temperature rose to 101.4° F. On the next day he had chills, fever, and sweats. A septic course persisted and on the fourth postoperative day a blood culture was positive for hemolytic *Staph. aureus,* coagulase positive. This organism was sensitive to chloramphenicol. Subsequent blood cultures (9 in all) consistently grew a similar organism. Later sensitivity studies showed the organism to be inhibited by: penicillin-chloramphenicol, neomycin, bacitracin-polymyxin B, chloramphenicol-streptomycin, and triple sulfonamides. Slight inhibition was noted to polymyxin B alone and resistance had developed to chloramphenicol alone. The organism was also resistant to penicillin, aureomycin, and streptomycin alone. This organism was cultured from fluid from the left lung.

On the eleventh day shortness of breath and chest pain occurred. The physical findings at that time were thought to be due to pneumonia. On the twelfth day a cardiac murmur was heard. It was initially described as blowing in character and best heard at the cardiac apex. Shortly thereafter the heart was found to be grossly enlarged and a grade 3, blowing systolic murmur was heard, with the maximum intensity at the lower end of the sternum. A diagnosis of acute bacterial endocarditis of the tricuspid valve, due to hemolytic *Staph. aureus* was established. At this examination, the spleen was palpable and a pleuropericardial friction rub was heard.

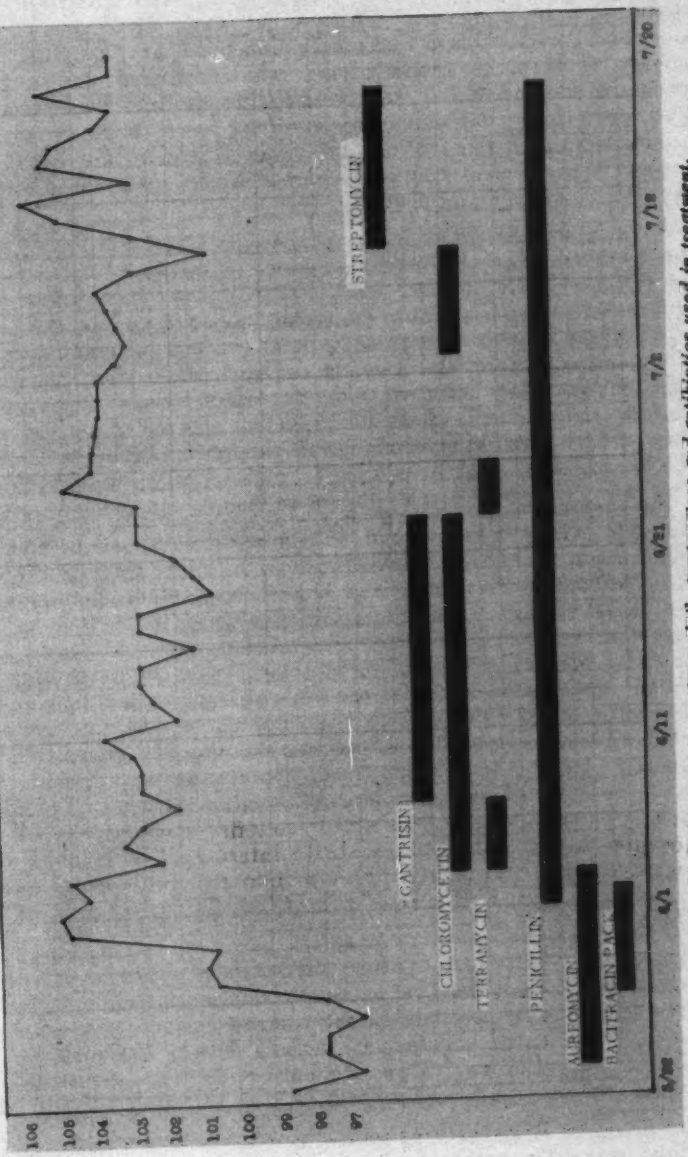

Figure 1. Graph showing maximum daily temperature and antibiotics used in treatment.

In spite of extensive therapy with aureomycin, terramycin, penicillin, chloramphenicol, streptomycin, and gantrisin, the septic course continued. Thirty-eight days after operation a localized pneumothorax seriously impaired his marginal pulmonary reserve. A thoracentesis was performed and a large amount of air and 300 cc. of serosanguineous fluid were removed. Two days later the pulmonary findings were those of tension pneumothorax. A thoracotomy tube was placed in the chest and suction applied. His course continued to be unfavorable and 51 days after operation he died (fig. 1).

At autopsy the right pleural cavity contained 400 cc. of thin, cloudy fluid. The left lung was partially collapsed by virtue of air in the pleural space. Scattered throughout both lungs were innumerable small nodules measuring up to 2 cm. in diameter. On incision, these were seen to be abscesses in various stages of evolution. There was a cystic cavity 3 cm. in diameter in the right lower lobe. Some of the abscesses located immediately beneath the pleura had ruptured into the pleural space. On section, there was honeycombing of suppuration and cavitation. The suppurative foci were seen to contain colonies of bacteria.

The heart weighed 400 grams. The tricuspid ring was dilated and the tricuspid valve leaflets contained an abundant crumbly fibrin deposit which had spread to involve the chordae tendineae. One leaflet of the valve was almost completely destroyed. A thin mural thrombus was found in the right ventricle near the ulcerated valve leaflet. Sections of the tricuspid valve area showed necrosis of the valve structure, much of which was replaced by masses of fibrin containing degenerating leukocytes and colonies of blue-staining bacteria. No evidence of systemic embolism was noted. The spleen weight was 680 grams. In the pilonidal area there was an open, granulating wound which was the site of the recent excision of a pilonidal cyst. The postmortem diagnosis was (1) acute bacterial endocarditis of the tricuspid valve, (2) multiple septic infarcts of both lungs with cavitation and spontaneous rupture into the left pleural space, (3) bilateral acute pleuritis, and (4) septic hyperplasia of the spleen.

Comment. In the first patient, widespread systemic embolization occurred and resulted in death; but because the tricuspid valve alone was involved in the second patient, the expected pattern was multiple pulmonary emboli due to fragmentation of bacterial vegetations. This syndrome has been described in several reviews and case reports (*9, 11, 13, 20-23*). Acute bac-

(20) Hussey, H. H.; Keliher, T. F.; Schaefer, B. F.; and Walsh, B. J.: Septicemia and bacterial endocarditis resulting from heroin addiction; report of 5 cases. J. A. M. A. 126: 535-538, Oct. 28, 1944.

terial endocarditis limited to the tricuspid valve and due to hemolytic *Staph. aureus* is extremely rare (*9, 11, 20, 21, 23*). Goldburgh et al. (*13*) reported that 11 of 584 (1.8 percent) cases of nonpneumococcus acute bacterial endocarditis were limited to the tricuspid valve.

DISCUSSION

These two cases not only present interesting diagnostic considerations, but they reflect a threatening trend in our bacterial population. A host of articles and editorials have warned the medical profession of the versatility and adaptability of bacteria (*2, 9-11*). Through a variety of mechanisms, many organisms have become resistant to one or more of the antibiotics in current use. Hemolytic *Staph. aureus* has been a classic example of this trend. Multiple studies have demonstrated that an increasing number of strains are naturally resistant to penicillin (*3, 5, 6, 8, 9*). Beginning with the studies of Barber and Rozwadowska-Dowzenko, reports have demonstrated the increasing incidence of naturally resistant strains of *Staph. aureus* being met in hospital practice. Resistance to other chemotherapeutic agents has also become common and the early conclusions that penicillin resistance could be effectively combated by the use of aureomycin or chloramphenicol already need revision (*4, 7*).

At present, antibiotic combinations offer hope of solution of some phases of this problem (*8*). A rational program to combat this ability of bacteria to select, adapt, habituate, and substitute must include close co-operation between bacteriologist and internist. Although in vitro sensitivity tests are not infallible, they give the clinician a definite indication of the antibiotic course he should pursue. Not only should the right agents be used, but they should be employed in adequate amounts. The development of resistance by pyogens during therapy is not common but does occur, and the early use of large doses of bactericidal or bacteriostatic drugs will assist in its prevention.

The second case demonstrates many aspects of this problem. Early in the hospital course, sensitivity to chloramphenicol in vitro was demonstrated. Doses routinely considered adequate, supplemented by other antibiotics, were unsuccessful. Antagonism between chloramphenicol and penicillin may have been a factor, but this cannot be proved. Later in the hospital course, the organism had become resistant to chloramphenicol but, in

(*21*) Wilhelm, F.; Hirsh, H. L.; Hussey, H. H.; and Dowling, H. F.: Treatment of acute bacterial endocarditis with penicillin. Ann. Int. Med. 26: 221-230, Feb. 1947.

(*22*) Barker, P. S.: Clinical study of subacute bacterial infection confined to right side of heart or pulmonary artery. Am. Heart J. 37: 1054-1068, June 1949.

(*23*) Luttgens, W. F.: Endocarditis in "main line" opium addicts; report on 11 cases. Arch. Int. Med. 83: 653-664, June 1949.

the test tube, was inhibited by a chloramphenicol-penicillin combination. Clinically, no response was seen to these two agents simultaneously administered so it must be assumed that the dose was too small.

A host of schedules for the treatment of acute bacterial endocarditis may be found. Orgain and Donegan *(24)* present a review up to 1950. No one program can be considered universally adequate and no such claims have been made. In the interim between diagnosis and sensitivity studies the patient should receive large doses of antibiotic combinations. Early diagnosis and intensive therapy offer the best solution to the problem presently confronting the physician caring for the patient with acute bacterial endocarditis. The future holds the possibility of better chemotherapeutic agents and a continually decreasing incidence of this disease as recognition of the potentially serious nature of infection and valvular lesions becomes more widely disseminated. It is further to be hoped that casual antibiotic therapy for bacterial infections will diminish as physicians become aware of the increasing incidence of bacterial resistance.

(24) Orgain, E. S., and Donegan, C. K.: Treatment of bacterial endocarditis. Ann. Int. Med. 32: 1099-1113, June 1950.

Immunization Requirements

An important new regulation for Army (SR 40-230-1), Navy (BUMEDINST 6230.1), and Air Force (AFR 160-102), entitled "Prevention and control of communicable diseases of man: Immunization requirements and procedures," has been published (5 Nov. 1952). The requirements are set forth for initial immunization, reimmunization, and special immunizations for four areas covering the entire globe. Strict adherence to these regulations will eliminate much of the unnecessary "shot-taking" practiced in the past.

EFFECTS OF CORTISONE ON ACUTE RHEUMATIC CARDITIS[1]

H. C. GIBSON, *Colonel, MC, U. S. A.*
DAN V. SPIVEY, *Captain, MC, U. S. A.*
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THE treatment of acute rheumatic carditis with ACTH and cortisone has received much attention *(2-5)*. The patients reported have been treated in all stages of the acute phase of the disease. No agreement has been reached regarding dose and duration of therapy. This treatment results in a rapid subsidence of acute symptoms, but the incidence of recurrent and residual valvular heart disease has not been determined.

The course of acute rheumatic carditis in children on salicylate therapy is usually of several months' duration, and in some it is years before all signs of acute carditis subside. Electrocardiographic changes and elevated sedimentation rates persist for weeks, months, or even years after clinical signs have disappeared. When the inactive stage is reached, about two-thirds are left with signs of rheumatic heart disease *(6)*. In adults, the course of the acute disease is variable but in general is less prolonged than in children and the mortality rate during the acute phase is quite low. Most of these patients survive, many with chronic crippling valvular heart disease.

No attempt is made here to review the general effects of hormone therapy, nor to describe the already often-repeated

(1) From the U. S. Army Hospital, Fort Jackson, S. C.

(2) Hench, P. S.; Slocumb, C. H.; Polley, H. F.; and Kendall, E. C.: Effect of cortisone and pituitary adrenocorticotropic hormone (ACTH) on rheumatic diseases. J. A. M. A. 144: 1327-1335, Dec. 16, 1950.

(3) Dorfman, A.; Smull, K.; Bergenstal, D. M.; Howard, R.; Muller, R.; Oleson, D.; and Senz, E.: Effect of adrenocorticotrophic hormone on rheumatic fever. Pediatrics 8: 603-615, Nov. 1951.

(4) Massell, B. F., and Warren, J. E.: Effect of pituitary adrenocorticotropic hormone (ACTH) on rheumatic fever and rheumatic carditis. J. A. M. A. 144: 1335-1341, Dec. 16, 1950.

(5) Kuttner, A. G.; Baldwin, J. S.; McEwen, C.; Bunim, J. J.; Ziff, M.; and Ford, D. K.: Effect of ACTH and cortisone on rheumatic carditis; observations on 18 cases. J. A. M. A. 148: 628-634, Feb. 23, 1952.

(6) Bland, E. F., and Duckett, J. T.: Rheumatic fever and rheumatic heart disease; 20-year report on 1,000 patients followed since childhood. Circulation 4: 836-843, Dec. 1951.

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mechanisms. Currently under the auspices of the American Heart Association and the British Medical Research Council, there is a co-operative study in 13 research centers to determine the relative values of ACTH, cortisone, and aspirin in the treatment of rheumatic fever (7).

We have observed the effects of cortisone on acute rheumatic carditis in 4 soldiers and have followed their progress for from 9 to 16 months. These men were all from an Infantry Replacement Training Division, which has continuous increments of inductees. All were from the southeastern states. They ranged in age from 19 to 27 years, and were admitted to the hospital early in the acute stage of rheumatic carditis. None gave a history of previous attacks of rheumatic fever, although one had been known to have a mitral systolic murmur for several years. All had ECG's consistent with acute pericarditis and 3 had friction rubs. Two were admitted within 24 hours after development of symptoms of acute rheumatic fever. One of these had joint manifestations for about 4 days and the other for 3 weeks prior to admission. All 4 patients were given cortisone within 72 hours after admission and all received antibiotics.

CASE REPORTS

Case 1. A 20-year-old man was admitted to this hospital on 20 December 1950. Three weeks prior to admission he developed pain, redness, swelling, and stiffness in his ankles, but continued his usual activities. These symptoms persisted; then 4 days prior to admission a low-grade fever developed. Subsequently, swelling, redness, and pain in both knees and severe pain in the anterior portion of his chest developed. On admission he was acutely ill, dyspneic, and ashen gray with a temperature of 100.8° F., a pulse of 140, and 30 respirations per minute. Tenderness, swelling, and hyperemia of both ankles and knees were present. There was a gallop rhythm, but no murmurs were audible. Moist rales were heard in the base of both lungs. His sedimentation rate was 30 (Cutler). His leukocyte count was 16,000. His ECG (fig. 1) showed elevation of the S-T segment in leads I, II, and CF_4. A diagnosis of acute rheumatic fever and carditis with early cardiac decompensation was made.

A grade II systolic mitral murmur and a pericardial friction rub was heard over the mitral area 48 hours after admission. The patient weighed 136 lb. Treatment with cortisone was started 72 hours after admission. He received 300 mg. in the first 24 hours; 200 mg. in the second; and subsequently was maintained on from 25 to 100 mg. daily. A total of 3 grams was given in 38 days.

(7) Editorial: A Co-operative Study. New England J. Med. 247: 186, July 31, 1952.

There was a period of 2 weeks in the middle of the course in which treatment was discontinued because of complications.

At the end of 24 hours of treatment there was beginning relief in symptoms and complete cessation of joint and chest pain in 48 hours. The heart rate became normal after 24 and the temperature after 48 hours. Gallop rhythm and swelling and redness of joints had disappeared in 48 hours. The rales noted on admission had completely cleared at the end of 72 hours. The pericardial friction rub and systolic apical murmur were no longer heard after 4 days.

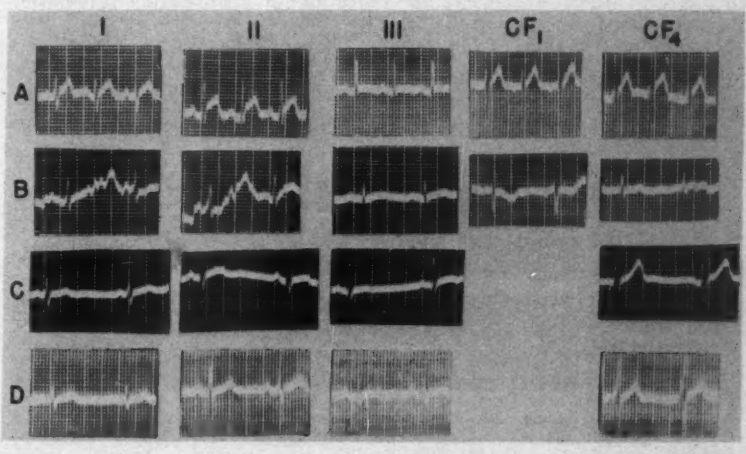

Figure 1. (A) *On admission: Rate 128; S-T segment elevation.* (B) *Three days after starting cortisone therapy: Rate 78; T wave low in* CF_4. (C) *Eleven days after starting cortisone therapy: Rate 62; S-T segments normal; T wave low in II.* (D) *Four months after admission: Normal tracing.*

The leukocyte count became normal (9,350) by the sixth day. Within 11 days after treatment was instituted, the ECG was normal (fig. 1). The sedimentation rate remained elevated (5 to 15) for 4 months.

The patient's course was complicated by the finding of glycosuria within 24 hours after cortisone was first administered. Fasting blood sugar determinations ranged between 142 and 155 mg. per 100 cc. but then returned to normal. The patient also developed depression and ideas of reference. These cleared 2 weeks after treatment with cortisone was discontinued and it was started again. He had one further brief similar episode after treatment was resumed. Two months after the completion of treatment he had no evidence of rheumatic involvement except for the persistent elevation in the sedimentation rate. This might be

explained on the basis of 6 periapical abscesses which necessitated extraction of teeth during the fifth month of hospitalization. At the end of 7 months there was still no evidence of recurrence. Physical examination, ECG, and sedimentation rate were normal. He was discharged to duty.

A follow-up examination on 10 March 1952 (15 months after the onset of acute illness) was negative.

Case 2. A 19-year-old man was admitted to this hospital on 21 January 1951. During the preceding 2 weeks he had had a sore throat and other symptoms of acute upper respiratory infection.

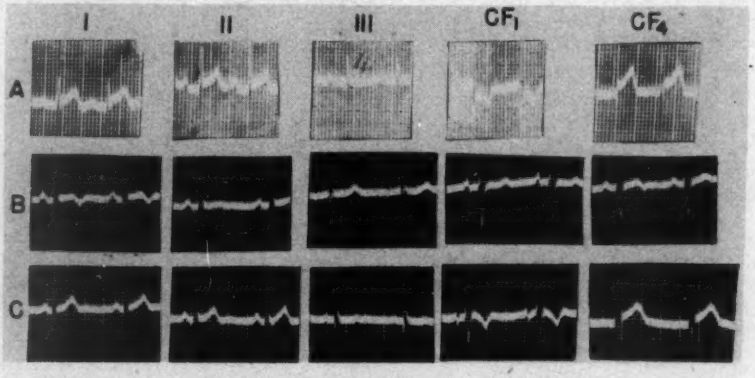

Figure 2. (A) *On admission: Rate 110; S-T segment elevation.* (B) *Seven days after starting cortisone therapy: Rate 80; no S-T elevation; T waves inverted in I and* CF_4. (C) *Seven weeks after admission: Normal tracing.*

Fever and painful swelling of his right knee appeared on the day before admission. Following this he had multiple joint involvement, generalized malaise, pain in the anterior portion of his chest, and anorexia. His temperature was 101° F. His pulse was 136. His respiratory rate was 24. Hyperemia of his pharynx and tonsils was marked. There was a gallop rhythm but no murmurs or rales were heard. Both knees, elbows, ankles, and shoulders were swollen, warm, and tender. The sedimentation rate was 34 (Cutler). The white blood cell count was 13,000. The ECG (fig. 2) showed S-T segment elevation in leads I, II, and CF_4. A diagnosis of acute rheumatic fever with carditis was made.

The patient weighed 198 lb. Cortisone was started 72 hours after admission. He received 300 mg. on the first day; 100 mg. on the second; and then 75 or 100 mg. daily. A total of 3 grams was given in 36 days. There was complete relief of his joint pain and a decrease of gallop rhythm in 48 hours. His tachycardia persisted for 7 days and his temperature returned to normal in 8

days. A systolic murmur was noted for the first time 3 days after treatment with cortisone was begun and persisted for 2 weeks. A friction rub was first heard 48 hours after treatment with cortisone was started and continued for 10 days. Joint swelling persisted for 30 days. The ECG reverted to normal after 7 weeks. The leukocyte count ranged between 13,000 and 26,000, but became normal (9,500) at the end of 1 month. The sedimentation rate remained elevated for 3 months.

This patient developed pulmonary edema 24 hours after treatment with cortisone was started. He was given digitalis and mercurial diuretics in addition to the cortisone. After 5 days he was compensated. After 18 days digitalis was discontinued. A roentgenogram and fluoroscopy of his chest showed generalized cardiac enlargement and pulmonary congestion. Six weeks later the roentgenogram of his chest was normal. Acne appeared 1 month after treatment with cortisone was started. This disappeared gradually following discontinuance of the drug. This minor complication is not uncommon. Two months after completion of treatment there was no evidence of cardiac involvement. The patient was discharged to duty on 11 May.

A follow-up examination in Korea in May 1952 was negative.

Case 3. A 27-year-old man was admitted to this hospital on 27 February 1951. Two weeks prior to admission he developed symptoms of acute coryza with a sore throat. These symptoms persisted and 1 week before admission he was given 300,000 units of procaine penicillin in oil. On the following day both knees became painful. The pain progressively increased during the next 4 days, becoming so severe that 1 day before entering the hospital he was unable to walk. On admission, joint pain was his only symptom.

His temperature was 99.4° F. His pulse was 82. His respiratory rate was 20. Both knees were tender, swollen, and contained fluid. Cardiac rhythm was regular and no murmur or friction rub was heard. A roentgenogram of his chest showed no cardiac enlargement. His sedimentation rate was 24. He had no leukocytosis. His ECG showed elevation of the S-T segment in CF_4 (fig. 3). His symptoms remained unchanged and treatment with cortisone was started within 72 hours. He was given 300 mg. on the first day; 200 mg. on the second; and 100 mg. daily thereafter. A total of 3 grams was given in 21 days. His joint symptoms disappeared in 48 hours. At no time was there any temperature elevation or tachycardia. There were no auscultatory findings until 16 days after treatment was started, when a grade I apical systolic murmur was heard, which persisted. No friction rub was heard. On the thirty-sixth day the ECG showed changes which

were more striking and suggestive of more extensive cardiac involvement. On the forty-second day these changes reverted toward normal but at the end of 5 months the ECG was still abnormal. At 6 months the only abnormality was slight elevation of S-T segments in V_3 and V_4. There was no leukocytosis at any time. The sedimentation rate remained elevated (9 to 16) as late as 6 months after the onset. A fasting blood sugar was found to be 177 mg. per 100 cc. 1 day after treatment with cortisone was started, but subsequent determinations revealed normal values.

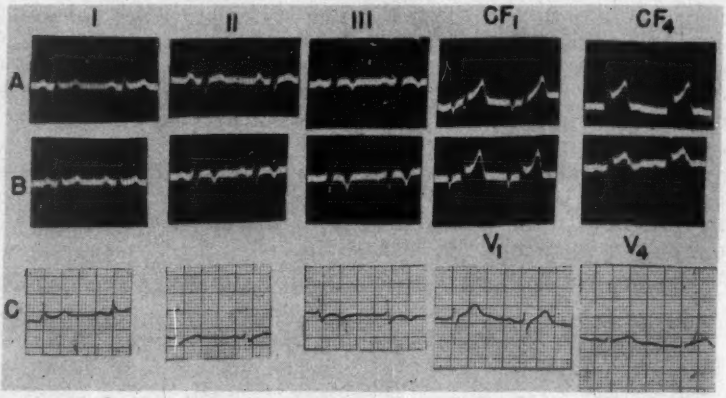

Figure 3. (A) *On admission: Rate 76: S-T segment elevation in* CF_1 *and* CF_4. (B) *Thirty-six days after starting cortisone therapy: Rate 88; inversion of T waves in II; S-T segment elevation in* CF_1 *and* CF_4. (C) *Six months after admission: Normal tracing.*

After 6 months the patient was discharged from the hospital, asymptomatic, with negative physical findings, except for a grade I apical systolic murmur. The ECG and laboratory studies were normal except for slight elevation of the sedimentation rate.

A follow-up examination 15 months after admission revealed no change in the physical findings or the ECG.

Case 4. A 24-year-old man was admitted to this hospital on 20 September 1951. In March 1950, when he tried to re-enlist in the National Guard, he was told he had a heart murmur. Following this he had had vague symptoms: palpitations, occasional heavy precordial distress, some exertional dyspnea, and a feeling as if his heart were missing beats. He had had frequent sore throats all his life and in 1949 had had a severe attack necessitating bed rest for 2 weeks. Two weeks before admission he again developed a sore throat, but on admission he was afe-

brile and no friction rub was heard. On the following day his temperature was 101° F. His pulse was 92. There were small tonsillar tags and moderate pharyngeal injection. He had a grade II systolic murmur at the apex. Also over the apex a to and fro pericardial friction rub which was not heard on admission was noted. There was a gallop rhythm with frequent premature contractions. He had no leukocytosis. A roentgenogram of his chest showed no cardiac enlargement. An ECG taken on the day before admission was normal.

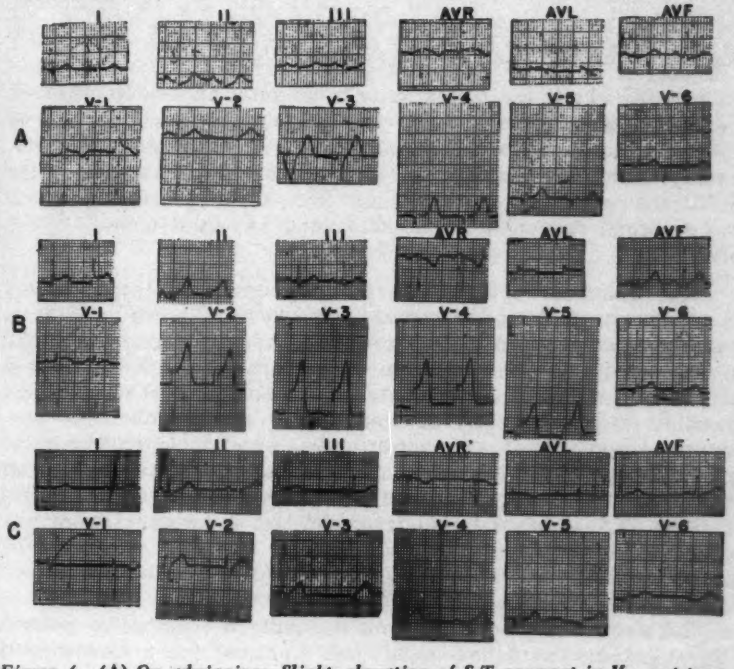

Figure 4. (A) *On admission: Slight elevation of S-T segment in* V_1, *not present 24 hours earlier.* (B) *Twenty-five days after starting cortisone therapy and at time of acute exacerbation: S-T segment elevation in I, II,* V_2, V_3, V_4, *and* V_5. (C) *Ten days later: Normal tracing.*

Treatment with cortisone was started 24 hours after hospital entry. He was given 300 mg. on the first day; 200 mg. on the second; and from 25 to 150 mg. daily thereafter. A total of about 4 grams was given in 6 weeks. Within 24 hours after treatment was begun there was a general subjective improvement and disappearance of the gallop rhythm. The temperature was normal in 48 hours. The pulse fell from 96 to 72. The systolic apical murmur noted on entry persisted unchanged throughout his hospital

course. The sedimentation rate was normal by the nineteenth day. By the twenty-fifth day the dosage of cortisone had been reduced to 25 mg., but on the following day the patient had an acute exacerbation of weakness, fever, feeling of impending doom, and generalized thoracic pain. The friction rub heard on entry had disappeared 4 days after treatment was started but was again noted 4 days later and was heard intermittently for 3 weeks. It was present during the exacerbation of symptoms. At this time the dose of cortisone was increased to 300 mg. for 1 day, 200 mg. for 1 day, then 100 mg. daily with gradual reduction. The friction rub disappeared within 3 days after the second course of treatment was started and never returned.

The ECG which was normal prior to hospital admission, showed S-T segment elevation on the day treatment with cortisone was started (fig. 4). This abnormality remained unchanged until the twenty-sixth day. Associated with the acute exacerbation, the ECG showed significant changes from those previously noted but returned to normal in 10 days and remained normal thereafter.

After treatment with cortisone was renewed in larger doses, the temperature returned to normal in 48 hours. The sedimentation rate, which had risen to 16, and the leukocyte count, which had risen to 16,950, with the acute exacerbation, returned to normal in 1 week and remained normal. The patient was observed for 4 months after completion of treatment with cortisone. He continued to complain of recurrent arthralgias and occasional thoracic pain. At the end of 9 months, he was asymptomatic except for transient arthralgias. The systolic apical murmur was unchanged but the ECG, sedimentation rate, and leukocyte count were normal.

RESULTS

The acute symptoms followed the pattern reported by others. Fever returned to normal in all but 1 patient (case 2) within 48 hours after treatment with cortisone was started. In this patient, whose fever lasted 8 days and was associated with severe congestive failure, it is now thought that the dosage was low during the first 4 days of treatment. In the face of pulmonary edema and cardiac dilatation, however, the dose was increased to 150 mg. daily on the fourth day of treatment. Following this, evidence of congestive failure cleared rapidly. Of the reports of the use of cortisone in the treatment of rheumatic carditis reviewed (3-5, 8, 9), a significant percent of each series developed con-

(8) Harris, T. N.; Abrams, W. B.; Leo, T. F. P.; and Hubbard, J. P.: Cortisone therapy in acute rheumatic carditis: preliminary observations. Circulation 3: 215-223, Feb. 1951.

(9) Barnes, A. R.: Effects of cortisone and ACTH in 14 patients with acute rheumatic fever. Proc. Staff Meet., Mayo Clin. 25: 478-479, Aug. 16, 1950.

gestive failure. Several of the observers questioned whether the decompensation noted was a complication of cortisone therapy or of the underlying rheumatic carditis. Some have suggested that cortisone *should* be given to patients with decompensation associated with acute rheumatic carditis because its action presumably relieves the underlying inflammatory process.

Except for 1 patient (case 2), tachycardia and gallop rhythm disappeared within 48 hours. Our 4 patients had murmurs during the acute episode. In 2, the murmurs disappeared completely and in 1 the murmur persisted unchanged. In the fourth, in whom there was a murmur antedating the acute symptoms, no change was noted. Friction rubs were present in 3 patients. In patient 1, the rub persisted for 4 days. In patient 2, the rub was first noted 48 hours after cortisone therapy was started and persisted for 10 days. In patient 4, a friction rub was noted on admission and was heard intermittently for 3 weeks. At this time, while the patient was receiving only 25 mg. of cortisone per day, he had an acute exacerbation of his carditis, and the dose of cortisone was increased to 300 mg. per day. After 3 days of this therapy, the rub was no longer heard.

In all 4 patients there were electrocardiographic changes consistent with pericarditis. In patient 3 this was the only evidence of pericarditis because no friction rub was heard. All 4 patients showed abnormal S-T segment and T-wave changes prior to the beginning of treatment and all reverted to normal. Two of these were normal within less than 2 weeks; 1 in 36 days; and 1 remained abnormal for 4 months, changing gradually to normal in 6 months. The P-R interval was normal throughout in all 4 patients. A review of recent literature revealed that in patients followed by ECG, the most common abnormality noted was prolongation of the P-R interval. There are very few reports of consistent return of the S-T segment and T waves to normal following treatment, but there are reports of abnormal conduction time returning to normal (*2, 3*). Kuttner et al. (*5*) reported 9 patients with pericarditis treated with ACTH and cortisone, in whom all evidence including electrocardiographic abnormalities disappeared within 3 weeks.

DISCUSSION

Salicylates lower the fever and relieve pain and discomfort in the articular tissues in patients with rheumatic fever. Whether salicylates shorten the course of the disease or prevent cardiac involvement is still under discussion (*10*). Striking symptomatic relief with cortisone and ACTH has been described in increasing numbers of patients. It is becoming clear that the adrenocortical

(*10*) Brams, W. A.: Treatment of Heart Disease. W. B. Saunders Co., Philadelphia, Pa., 1948. p. 112.

steroid hormones do not permanently modify the pre-existing pathologic lesions *(11)*. The persistence of lesions was demonstrated at autopsy by Spain and Roth *(12)*. There is, however, insufficient evidence to quell the hope that these hormones interrupt the progress of lesions and prevent the formation of new Aschoff bodies in the myocardium and cardiac valves.

If these drugs in adequate dosage check the course of rheumatic fever, the residual cardiac damage may then depend on how early in the disease treatment is started. Acute joint involvement frequently precedes evidence of carditis in young adults. The possibility of preventing heart damage by early therapy may be especially good in those patients in whom the acute episode manifests itself first in the joints. This, however, must await statistical study of a large number of treated patients. The 4 patients reported here all had acute carditis from 1 to 3 days before therapy was started, hence a certain amount of valvular damage may be expected.

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(11) Shaw, C. C.: Clinical critique of ACTH and cortisone. Mil. Surgeon 110: 42-51, Jan. 1952.

(12) Spain, D. M., and Roth, D.: Effect of cortisone and ACTH on histopathology of rheumatic carditis; report of necropsied case. Am. J. Med. 11: 129-131, July 1951.

BOOK REVIEW

The Cardboard Giants, by *Paul Hackett*. 309 pages. G. P. Putnam's Sons, New York, N. Y., publisher, 1952. Price $3.50.

This book is purported to be the autobiographic experiences of a veteran who was admitted to a Veteran's Hospital with a diagnosis of a schizophrenia, paranoid type, severe with poor prognosis. After a year of hospitalization, he was discharged. The author describes his illness ably. Later, there are some gems of discussions among patients and others, including one with a "Doc Shepard" in a late latrine session. This book is not recommended for patients and it adds nothing to the psychiatrist's knowledge.—*Comdr. S. V. Thompson, MC, USN*

EPIDERMOID CYST OF THE SPLEEN

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LeROY H. STAHLGREN, *Lieutenant, junior grade, MC, U. S. N.*

CYSTS of the spleen are uncommonly encountered but because they frequently present fairly typical clinical findings, they can occasionally be correctly identified preoperatively. The literature relating to epidermoid cysts of the spleen was reviewed by Shawan *(1)*, who reported 4 cases, and later by Radakovich *(2)*, who added 1 of his own and collected 6 others. Other types of splenic cysts are seen more commonly and include: (1) primary or true cysts (congenital, traumatic, inflammatory, neoplastic *(3)*, and ecchinococcus) and (2) secondary or false cysts which have no true epithelial lining and are due to trauma, inflammation, or degeneration *(4)*.

CASE REPORT

A 21-year-old man was admitted to the U. S. Naval Hospital, Guam, on 3 March 1952, by a physician who had noted the presence of an abdominal mass on routine physical examination.

Although the patient was aware of the mass, it did not interfere with his daily activities, which included climbing a 60-foot ladder to an observation tower several times daily. He had first become aware of the abdominal swelling 6 or 7 months before admission and stated that the enlargement seemed to be increasing fairly rapidly. There was no noticeable change in appetite or weight. He had observed, however, that the caliber of his stools had decreased slightly. This was interpreted to be the result of extrinsic pressure on the distal portion of the descending colon. There was no respiratory embarrassment.

Three years before admission the patient had suffered an abdominal injury while playing football. He was acutely uncomfortable for several days and finally turned in at the dispensary where he was detained for 3 days. During this period the diagno-

(1) Shawan, H. K.: Epidermoid cysts of spleen. Arch. Surg. 27: 63-74, July 1933.
(2) Radakovich, M.: Epidermoid cyst of spleen; report of case. Ann. Surg. 131: 268-276, Feb. 1950.
(3) Epidermoid cysts belong in this group.
(4) Fowler, R. H.: Cystic tumors of spleen. Internat. Abstr. Surg. 70: 213-223, 1940.

sis of appendicitis was considered. The relation of this injury to the condition on admission has not been established but some peritoneal irritation could have resulted from intra-abdominal bleeding such as would occur following trauma to the liver or spleen. He subsequently recovered completely and had experienced no other episodes of abdominal pain.

On physical examination, a smooth, rounded, nontender mass which filled the left upper abdominal quadrant and flaring of the left lower costal margin were noted (fig. 1). The mass extended across the midline several centimeters and downward to a point just above the iliac crest. It moved with respirations but was not ballotable. It did not pulsate. The erythrocyte count was

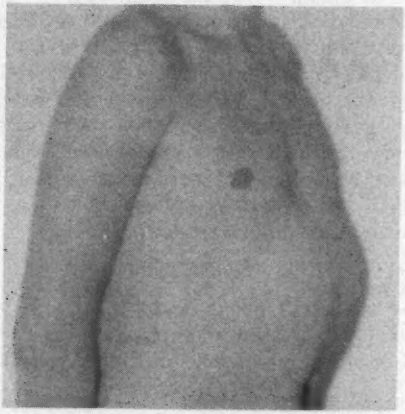

Figure 1. Photograph showing large tumor protruding in the left upper abdominal quadrant.

4,350,000; the hemoglobin was 13 grams; the leukocyte count was 8,800 with a normal differential count. The prothrombin time was 65 percent. The coagulation time (Lee-White method) was 3 minutes. Bone marrow obtained by sternal puncture contained no abnormal elements and indicated adequate erythropoiesis.

Fluoroscopy revealed that the left leaf of the diaphragm was markedly elevated. Retrograde pyelography showed inferior displacement of the left kidney in its normal plane by the mass (figs. 2 and 3). It was therefore assumed that the mass was within the abdominal cavity and did not arise retroperitoneally. There was no direct connection between the tumor and the left kidney. A gastrointestinal series revealed marked compression of the stomach and duodenum with displacement to the right. The duodenal loop was widened. The transverse colon and splenic flexure were displaced anteriorly and inferiorly and bore no direct relation to the mass.

Figure 2. Anterior pyelogram showing inferior displacement without anterior displacement of the left kidney. The mass is outlined with arrows. Figure 3. Lateral pyelogram showing inferior displacement of the left kidney in normal plane. The mass is outlined with arrows.

A laparotomy was performed on 24 March. A smooth, rounded, cystic mass covered by omentum, which was adherent over its anterior surface, was found. Superiorly, it was adherent to the left lobe of the liver and to the diaphragm. The cyst wall was fibrous and gray white. Following the aspiration of 5,000 ml. of dark, watery fluid mixed with débris from the cyst, a fringe of splenic tissue could be identified along the inferior margin of the mass. Splenectomy was performed after freeing the adhesions. These adhesions were unusually vascular. A transfusion of 500 ml. of whole blood was given during the operation.

The postoperative course was uneventful. The patient was discharged on the fourteenth postoperative day, and 2 months later he had no complaints. The usual postsplenectomy platelet increase did not attain the expected levels, probably because of the absence of normal splenic function preoperatively. Before operation the platelet count was 195,000. This rose to 280,000 on the first day, reached a peak of 640,000 on the eighth day, and fell to 220,000 on the fourteenth day.

The pathologist reported that the spleen measured 30 by 21 by 4 cm. One pole revealed a relatively intact, red-brown, normal-appearing architecture. The remainder consisted of an enormous, collapsed cyst about 20 cm. in diameter. The wall varied in thickness from 0.4 to 2.5 cm. The external surface showed areas of torn fibrous adhesions and hemorrhagic and yellow-gray discoloration. The inner lining was composed of a grossly trabeculated membrane which superficially resembled trabeculae carneae. In addition, there were numerous, small, secondary cysts widely distributed throughout many aspects of the wall of the large cyst. Most of these contained clear yellow-green fluid, or blood under great pressure. There were many hemorrhagic areas beneath the cyst wall.

Microscopic examination of the noncystic pole of the spleen revealed fibrosis and ectasia of the sinusoids. There were numerous small cysts lined by pavement and stratified epithelium in some areas. The major cyst was lined by low pavement and stratified squamous epithelium. Based on these findings, a diagnosis of epidermoid cyst of the spleen was made.

CONCLUSIONS

The following findings are important in the diagnosis of splenic cysts: (1) the presence of a nontender, cystic mass in the left upper abdominal quadrant; (2) the demonstration by retrograde pyelography of inferior displacement of the left kidney in its normal plane; and (3) the anterior and lateral displacement of the stomach and duodenum and the inferior and anterior displacement of the transverse colon.

SIMULTANEOUS PERFORATED APPENDICITIS, VIVAX MALARIA, AND ASCARIASIS[1]

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ERIK LARSEN, *Captain, MC, USAR*

IT is unusual in this country, since the end of World War II, to see a patient having a simultaneous attack of appendicitis, vivax malaria, and ascariasis. Many men are now returning from Korea and because similar occurrences in which a delay in operating might prove injurious will probably be seen, we hope that this report may be of value. In the spring of 1951, large numbers of troops began rotating to the United States from Korea and attacks of malaria among them increased in frequency, reaching a peak of more than 600 per week (2, 3). An unknown but undoubtedly large number of these patients also have ascariasis. Malaria, ascariasis, and appendicitis may all be associated with acute abdominal pain (4) but only appendicitis (with rare exceptions) warrants operation (5).

CASE REPORT

A 20-year-old man, recently returned from Korea, was admitted to this hospital late in the afternoon of 23 June 1952. He became ill late in the evening of 22 June while driving from his home in Wyoming back to camp for separation. He complained of nausea, vomiting, generalized aching, and vague abdominal pain. He appeared to be acutely ill and his temperature was 105.4° F. There was slight tenderness (but no rebound tenderness) in his right lower abdominal quadrant. Rectal examination revealed slight tenderness of the anterior rectal wall. Blood smears were negative for malaria and a blood count taken before

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(1) U. S. Army Hospital, Camp Carson, Colo.

(2) Alving, A. S.; Arnold, J.; and Robinson, D. H.: Status of primaquine; mass therapy of subclinical vivax malaria with primaquine. J. A. M. A. 149: 1558-1562, Aug. 23, 1952.

(3) Primaquine for vivax malaria. (Editorials and Comments Section) J. A. M. A. 149: 1573, Aug. 23, 1952.

(4) Pizzillo, G., and Serio, F.: Sindromi addominali acute da malaria; pseudocolecistite—pseudo-appendicite. (Acute abdominal syndrome in malaria; pseudocholecystitis and pseudo-appendicitis.) Riv. malariol. 29: 315-320, Oct. 1950.

(5) Shrum, R. C.; Lanard, F. W.; and Wilkerson, D. C.: Spontaneous rupture of spleen in malaria; report of case. J. A. M. A. 149: 660-661, June 14, 1952.

admission showed a moderate leukocytosis. A tentative diagnosis of malaria was made and an acute surgical abdomen was also considered.

On the following morning the patient developed more definite signs of an acute pelvic peritonitis and was operated on. The preoperative leukocyte count was 16,800 with 81 percent neutrophils and 19 percent lymphocytes. The hemoglobin was 16.5 grams per 100 cc. A blood smear was positive for *Plasmodium vivax*. A right rectus incision was made under spinal anesthesia and a perforated gangrenous appendix was found. There was free pus in the peritoneal cavity. The appendix was removed and the wound was drained and partially closed. Six hours postoperatively the patient coughed up a worm 6 inches long which was identified as *Ascarias lumbricoides*. The patient was treated postoperatively with penicillin, streptomycin, chloroquine, and hexylresorcinal and made a satisfactory recovery.

Comment. In this patient, appendicitis probably precipitated the malarial attack *(6)* and ascariasis was an incidental finding. Because similar cases will be seen more frequently as more troops return to the United States from Korea, we hope, that in spite of the finding of a positive malarial smear, surgeons will not delay abdominal exploration when signs of an acute surgical abdomen are present.

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(6) Paparella, J. A.: Malaria in returned veterans of Korean War. J. A. M. A. 149: 834-838, June 28, 1952.

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